the OIL AND GAS JOURNAL
PUBLISHED WEEKLY March 7, 1960

FPC hopes to speed up hearings ▸ 57

Two deep wells hit in Delaware basin ▸ 64

Another major find made in Libya ▸ 78

Putting linear programing to work ▸ 113

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OIL AND GAS JOURNAL
Vol. 58, No. 10

Contents March 7, 1960

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TECHNOLOGY—OPERATION

Pipelining

Full Automatic Control for Pipelines 94

By Geoffrey Post

There are several important reasons for computer control, in addition to the obvious tangibles such as saving manpower and raising routine efficiencies. These have to do with planning ahead for population growth, urban expansion, and tie-ins with other lines.

Kuwait Terminal Will Switch from Manual to Remote Operation .. 125

A system has been designed for the automatic handling of the 1,500,000-bbl. daily production of Kuwait Oil Co. through the north and south tank farms at Ahmadi. Manual measurements provide the basis for calculating crude volumes. And it is hoped that the supervisory system will take over this function.

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Drilling

Automatic Optimum Control for Drilling 84

By Ed McGhee

Field tests have proved that drilling times can be greatly reduced without adding a single new piece of equipment at the rig. The new advance is the result of picking bit weights and rotary speeds on the basis of scientific fact rather than on personal experience. Actual goal is finding weight-speed combinations to produce the lowest possible costs per foot of hole drilled.

Production

How to Evaluate Corrosion Inhibitors for Sea-Water Floods 88

By Charles C. Wright

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Implosions Improve Well Injectivity 92

By D. D. Setser and J. P. Moran

A new well-stimulation device, known as an implosion capsule, has been developed for use in gas and oil wells. The new method helps wells accept acid and other stimulating fluids. The technique opens the way for a successful fracturing of hard-to-fracture formations.

Reservoir Engineering—No. 21 106

By E. T. Guerrero and F. M. Stewart

How to obtain relative permeabilities and relative permeability ratios from laboratory unsteady-state displacement data.

Refining-Processing

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Here's a look at some of the factors which affect flow in refineries.

How Feed Boiling Range Affects Cat Cracker Operation 98

By R. L. Flanders, J. G. Girard, and B. D. Laughlin

Average feed boiling point can be used to predict conversion, the major products of conversion, gasoline octane, and gas composition. With data of the type developed in this article, an operator can achieve optimum distribution of available feed components to his cracking units.

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Operating costs for viscosity breaking.

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Linear Programing and How It Is Applied 113

By John E. Chenevey

The first of three articles in which the author explains a useful tool in nonmathematical terms. This installment is a general introduction.

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
March 7, 1960

Product markets are in a twilight zone:

Middle distillates have had a disappointing season with prices shaken by untimely weather.

Gasoline-consuming market has not yet warmed up to get any real test.

Here's the rundown:

...No. 2 has little spot demand on Gulf or East Coast. You can get prompt liftings in volume on Gulf at ½c per gal. under posted 8c price. This may drop another ¼c. Midwest price is down ⅝c per gal. in Chicago (p. 184).*

...Gasoline outlook in near future is spotty. Price in Mid-Continent for northern shipment has advanced 1c during February. Back of this is desire to realize more to make up for sinking middle distillate prices. Inventories are too high in Midwest, better on the coasts.

...No. 6 is not strong at $2 on Gulf. But low sulfur No. 6 is firm at $2.25 per bbl., the strongest product on the refiner's shelf.

...Crude prices, especially in Texas and Gulf Coast, are weak and under heavy pressure. Cause is weak No. 2 price situation and the untested summer demand for gasoline.

Hard to figure what will happen to runs.

One segment of the industry has quit chasing the incremental barrel and reportedly is cutting crude runs.

Another segment reasons that any profit from No. 2 is gone for this heating season. These may hold crude runs high to make more gasoline for the approaching motoring season.

This split means runs probably will remain high instead of being patterned to product demand.

▼ ▼ ▼

Domestic drillers are glad to see February go.

Rotary rigs operating averaged only 1,660 during the month. That's lowest February average in 9 years. Highest

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

is 2,706 in 1952. Average last year was 1,816, or 156 more than this February.

Completions also show the same decline.

For year to date, completions total 7,295 compared with 8,096 for like period in 1959, a decrease of 801.

Development wells are off 815. This is offset some by a 14-well gain in wildcat completions.

▼ ▼ ▼

Two oil trends currently offset pessimism in some quarters at oversupply of crude.

Traders report:

...Bargains in producing properties offered for sale are scarce and hard to find.

...Investors, especially small syndicates, still have venture capital to risk on good drillable prospects.

Like riddles? Here's one oil economists wish they could answer:

Crude stocks of large volumes traditionally are carried, often for long periods, by oil companies without too much concern.

Product stocks, however, get a bit high and marketers dump them on the market no matter what happens to price.

Economists so far have no logical explanation for this bit of schizophrenia.

▼ ▼ ▼

Crystal-balling autos and gasoline:

By 1966, average compression ratio of new cars will be about 10.4:1, predicts John R. Sabina, planning manager of Du Pont's petroleum chemicals division. This means octane requirements will rise in next 6 years with 103.5 octane needed to satisfy 95% of new cars to 98 to accommodate at least 50% of the 1966 models.

By 1976, motor vehicles in U. S. will be burning 97 billion gallons of fuel annually compared with an estimated 55 billion gallons in 1959.

Other predictions for 1976 by Commerce Department: 230 million people traveling 1.2 trillion miles in 114 million motor vehicles (for 1959, an estimated 176 million population used 70 million vehicles for 696 billion miles).

▼ ▼ ▼

Efforts to extend Michigan's Trenton play northwest of Albion may soon pay off.

The James O. Kelly 1 Dunlap in Calhoun County on drill-stem test at 4,414-74 ft. gaged 5,200 M.c.f. of gas with samples showing oil-saturated dolomite. Drilling is going ahead. The wildcat is 10 miles northwest of Albion pool.

Central Montana has best oil find in 2 years at Sinclair wildcat south of Sumatra in Rosebud County. Well flowed 30 bbl. per hour during test of good Amsden section.

A 3-mile oil extension has been made to Table Rock field in Wyoming's Green River basin by Schieck-Scimitar Oil's 1 Government-Mattonen.

Well flowed 875 bbl. oil daily from Almond Cretaceous perforations at 6,781-6,801 ft. Earlier test made 7,000 M.c.f. daily of gas from the Almond. Gas production is a mile southwest and oil is 3 miles north.

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The Alaska scene:

Encouraging shows of oil and gas were reported by California Standard in its wildcat on the 70,728-acre Soldotna Creek unit on Kenai peninsula. Casing was set to 10,922 ft., and crew is drilling ahead. Tests of encouraging zones will be run when well reaches total depth.

High bids totaled $206,027 on 16 lease tracts covering 9,000 acres in Gubik gas structure north of Brooks range in Alaska. Bids averaged $22.63 per acre. Hunt interests of Dallas got 10 tracts of 5,640 acres for $160,525. Colorado Oil & Gas Corp., Denver, took six tracts of 3,465 acres for $45,502.

Shell reportedly plans to put a geophysical crew in the field this summer to make a broad general survey of its new Bethel basin development contract. Deal calls for Shell to spend $200,000 in preliminary exploration.

▼ ▼ ▼

Gas in the news: FPC is adopting new procedure in effort to speed up disposition of natural-gas cases (p. 57)...Top oil and gas play of year may be unfolding in Delaware basin where Mobil is completing big strike in Pecos County (p. 64) ...FPC has hiked interest rate producer or pipeline must pay if it has to refund a rate increase. It's now 7% (p. 58).

Of interest to production men: First sizable pressure-maintenance project in the Gulf is nearing first birthday. It halted alarming drop in reservoir pressure and actually started the pressure upward (p. 75).

Drillers note: First field trials have been completed on mud-driven percussion drill. Results were termed inconclusive (p. 68)...Relief well moves close to high pressure sand which has fed South Louisiana's wild well since January 12 (p. 63).

Another major oil field looms for Libya. Oasis Oil, most active wildcatter in the country, won't talk about its discovery, B1-59. Observers in Libya already rank the strike second in the country behind Esso's big Zelten field (p. 78).

Relief from oil import appeals board will be hard to get. In first rulings last week, board turned down all five appeals. Outlook is that other 45 appeals face tough sledding (p. 60).

▼ ▼ ▼

New large-diameter gas line is being planned from the western Oklahoma-Texas Panhandle area northeastward beyond St. Louis.

The promoter is buying large volumes of gas, some of which will be available for sale to other pipelines.

Popularity of gas in home-heating market is illustrated in Chicago, where more than 60% of single-family dwellings are now connected.

The Peoples system there reports that of 4,400 new homes completed in Chicago last year, 99.2% heat with gas.

A home furnace no larger than a refrigerator coil is predicted by gas experts.

One heater is a porous ceramic tube. A gas-air mixture is fed into it under pressure. After the mixture is ignited on the outside of the tube and the tube has come up to temperature, essentially flameless combustion is maintained. The tube glows with a 2,000° heat. This warms the air fanned through the house.

Dimensions of the new furnace could be about half the size of present compact warm air furnaces with efficiency about 10 to 12% greater. New equipment is delayed by need to develop controls, valves, and fans.

▼ ▼ ▼

The Teamsters took a real beating in the union representation election at Esso's Bayway refinery. But their 136 votes now could decide the runoff election tentatively set for March 17.

OCAW seems to be favored. It polled 597 to 533 for Independent Petroleum Workers. NLRB ordered the runoff because neither got a majority.

If OCAW wins, the union will have two of Jersey's three largest domestic refineries. OCAW won last fall at Humble's Baytown plant but lost in the Esso Baton Rouge plant.

Quick rejection has been made by OCAW local to final offer of Indiana Standard management to settle strike at Sugar Creek, Mo., refinery.

Workers have been on strike since last July 8.

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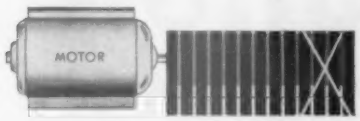
B.F.Goodrich V belt briefs

TIPS ON THE CARE, MAINTENANCE AND SELECTION OF V BELTS FOR INDUSTRY

BFG V belts have 40% greater horsepower rating, cost no more

All B.F.Goodrich V belts now have 40% greater horsepower rating. This higher capacity rating was formerly found only in high capacity belts, but now costs *no more than former standard belts.* This means that lighter, more compact, and lower cost drives can now be used, because these B.F.Goodrich belts carry the horsepower needed for efficient drives using fewer belts at standard belt prices.



9 V belts can now do work of 13.

What caused these failures?

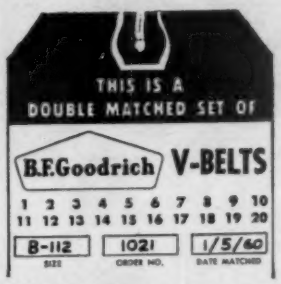
Answer: Prematurely worn sides are caused by grit, dirt or any such abrasive contact. Misalignment often causes wear on one side only. To prevent, align the sheaves, checking with straightedge or cord. Keep belts and sheave grooves clean.

Answer: Belt put on improperly, or foreign objects fell into groove to rupture cover fabric. To prevent, move motor toward driven sheave when replacing belt. If rupture was caused by foreign object, protect belts with a cover.

BFG double matching program keeps V belts matched during the life of the drive

Double-matching assures you that a set of B.F.Goodrich V belts are of equal length when installed and will stay uniform in length for the life of the belts. When V belts of different lengths are put on the same drive, longer belts loaf, while shorter ones carry all the load and fail quickly. B.F.Goodrich double-matched belts are measured *twice* for uniform length, once when manufactured and again after storage. Only belts that are of equal length when manufactured and after storage are grouped into sets.

Belts that are grouped into sets are tied together with a tag which gives the date when belts were matched. Belts which have been in storage over a year and "tag ends" are returned to BFG for replacement to make sure that your distributor always has a fresh stock of double-matched belts.



Here's the tag which goes on each set of double-matched belts, giving exact date belts were matched.

How to protect against static electricity in V belt drive

Static electricity is developed on every V belt drive. If there is an explosive atmosphere under certain conditions it can trigger an explosion.

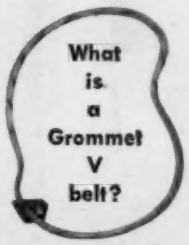
Various means are used to get rid of this static charge. The most reliable method is in the use of static conducting V belts which are grounded to both the motor and the driven unit.

But unless the motor and the driven unit are properly grounded there can be no protection regardless of the type of static conducting V belt used.

Static conductivity in a V belt is made possible by special compounds used in the cover. Because cover wear reduces the belts' ability to conduct static, drives should be inspected frequently. Any belts showing cover wear should be replaced immediately. With any set of V belts, it is good practice to replace the entire set.

When ordering BFG Multi V belts, "static conducting" belts must be specified and cost slightly more. All BFG Maxipower V belts are static conducting and heat and oil-resistant at no extra cost.

The Question Corner—



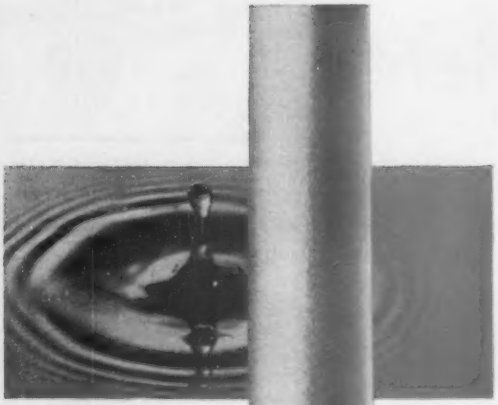
Grommet construction is exclusive in B.F.Goodrich V belts. Grommets are two extra strong cord loops, inside the belts, like twisted cables, except they are endless. Unlike ordinary belts, there are no center cords in the Grommet belt, so it is more flexible, can "give" temporarily and absorb shock loads.

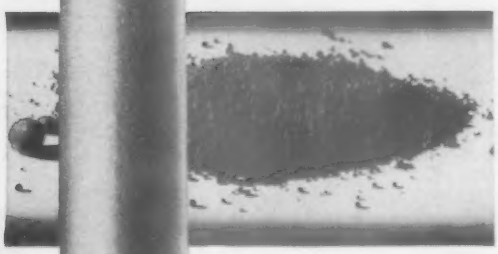
Let your B.F.Goodrich distributor show you how this higher capacity, longer belt life, ability to stand hard use, can reduce your V belt costs per year and make other savings in operating and maintenance costs.

Ask a factory-trained specialist

For help in selecting V belts for any kind of service, call the man who is a specialist in V belts—your B.F.Goodrich distributor. He can help you cut costs by getting longer life from your V belt drives. *B.F.Goodrich Industrial Products Company, Dept. M-798, Akron 18, Ohio.*

B.F.Goodrich V belts





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give Grade "Y" Sucker Rods remarkable resistance to fatigue

The high elastic strength . . . and, therefore, the high fatigue resistance . . . of "Oilwell's" Grade "Y" Sucker Rods, is an excellent example of what research can do to make a better product. Water and boron are common materials; but how they are used in manufacturing sucker rods makes the big difference.

The Grade "Y" steel does not contain much boron . . . just about .0005 per cent. But boron alone does not give these rods their high resistance to fatigue. That comes from the water . . . . when the rod is *liquid quenched.* Liquid quenching brings out the optimum properties of boron in the alloy and gives Grade "Y" Sucker Rods the highest available elastic strength . . . the greatest possible resistance to the stresses which cause fatigue.

If your wells are deep—either non-corrosive or inhibited—Grade "Y" Rods were designed for your use. They will eliminate much lost production and costly "fishing" time . . . and they will prolong service life of the string many months beyond other, more expensive so-called "high strength" rods. They can be furnished with standard or slim hole, Grade "S" or Co-Hard couplings.

Why not try Grade "Y" in your next well? Run an "alternate rod" test, with every other rod on the string an "Oilwell" Grade "Y" and learn for yourself how economical they really are.

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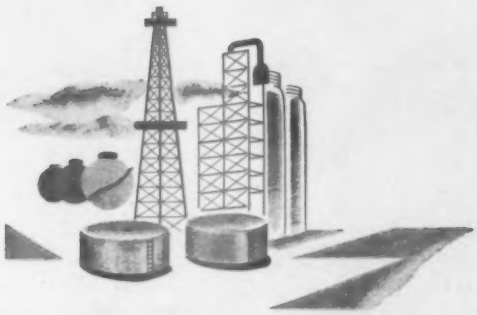

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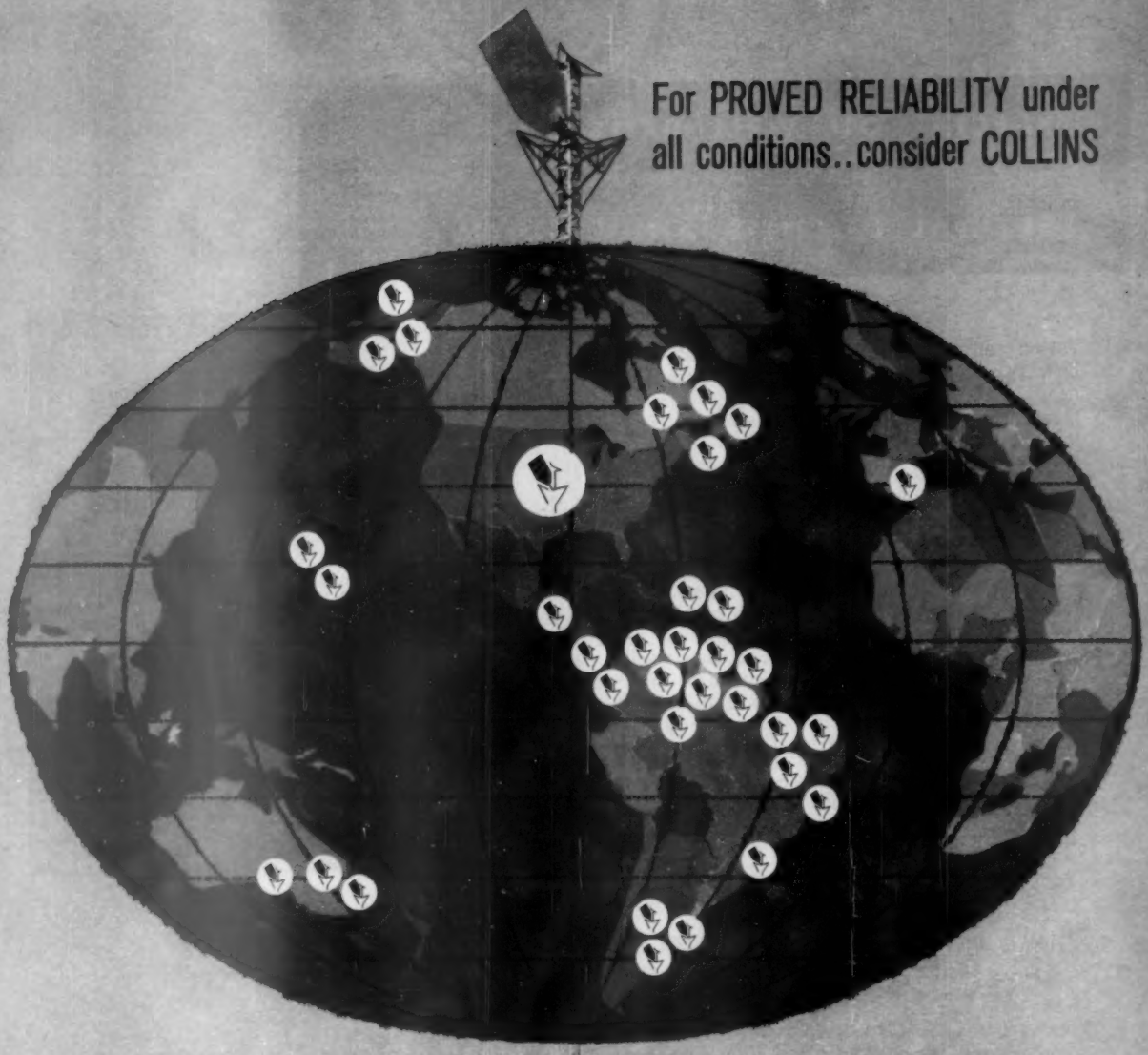

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POZMIX CEMENT ... THE OUTSTANDING POZZOLANIC COMPOSITION

Pozmix Cement is a blend of pozzolanic materials and portland cement with desirable characteristics that cannot be obtained with neat portland slurries. It is resistant to sulfate and salt water corrosion. Pozmix Cement is also lower in cost, easier to pump, easier to perforate, less permeable and more durable. It has an outstanding record of proven performance in a wide variety of applications.

POZMIX 140 ... FOR HOT, DEEP WELLS

Designed for oil well cementing where formation temperatures range from 140° to 400° or higher, Pozmix 140 is a pozzolanic composition made up of Pozmix "A" or "S", hydrated lime and set control additives to give it early initial strength. It contains no portland type cement. At temperatures above 140°F, Pozmix 140 equals or exceeds strength specifications for oil well cements, yet is designed to provide a maximum pumpability in the deepest of wells. Results with Pozmix 140 have demonstrated its effectiveness in every case.

RADIO-ACTIVE CEMENT... NEWEST SCIENTIFIC AID

RAC-1 and RAC-2 are useful in locating cement tops, even in multi-stage jobs, locating the treated zone after squeeze cementing, locating split pipe. Half-life of material makes for safe, surer identification of cement, even after considerable delays following original job. No contamination to equipment or production. Also RAYFRAC Sand, for use in fracture location and differentiation.

HR-4... RETARDER

A small amount of HR-4 added to the mixing water or the dry cement at Halliburton bulk plants results in a composition with a retarded set, permitting placement at high temperatures. It is used with portland or Pozmix Cement in the deepest of wells.

HR-7... DISPERSANT AND RETARDER

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HA-5... AN EFFECTIVE ACCELERATOR

An improved accelerator for oil well cementing slurries to be used for surface pipe or shallow wells. Higher compressive strengths at early ages are obtained, permitting W. O. C. times as short as four hours on surface pipe at temperatures of approximately 80°F.

MUD-KIL... AN EFFICIENT NEUTRALIZER

A dry, granular material that effectively neutralizes the cement-retarding properties of mud treating chemicals such as quebracho and other tannins, starch, sodium carboxymethyl cellulose and lignite. Pumping time and compressive strengths of cement remain relatively constant.

HI-DENSE... HELPS TO CONTROL HIGH PRESSURE ZONES

Ground to a fineness that requires a minimum amount of mixing water, Hi-Dense is designed to increase the density of cement slurry and aid in controlling high pressure gas and oil zones. Because of the high specific gravity of Hi-Dense, it is possible to weight cement slurries to 20 lbs./gal., yet still maintain pumpability and strength stability at high temperatures.

HALLIBURTON CEMENTING SERVICES

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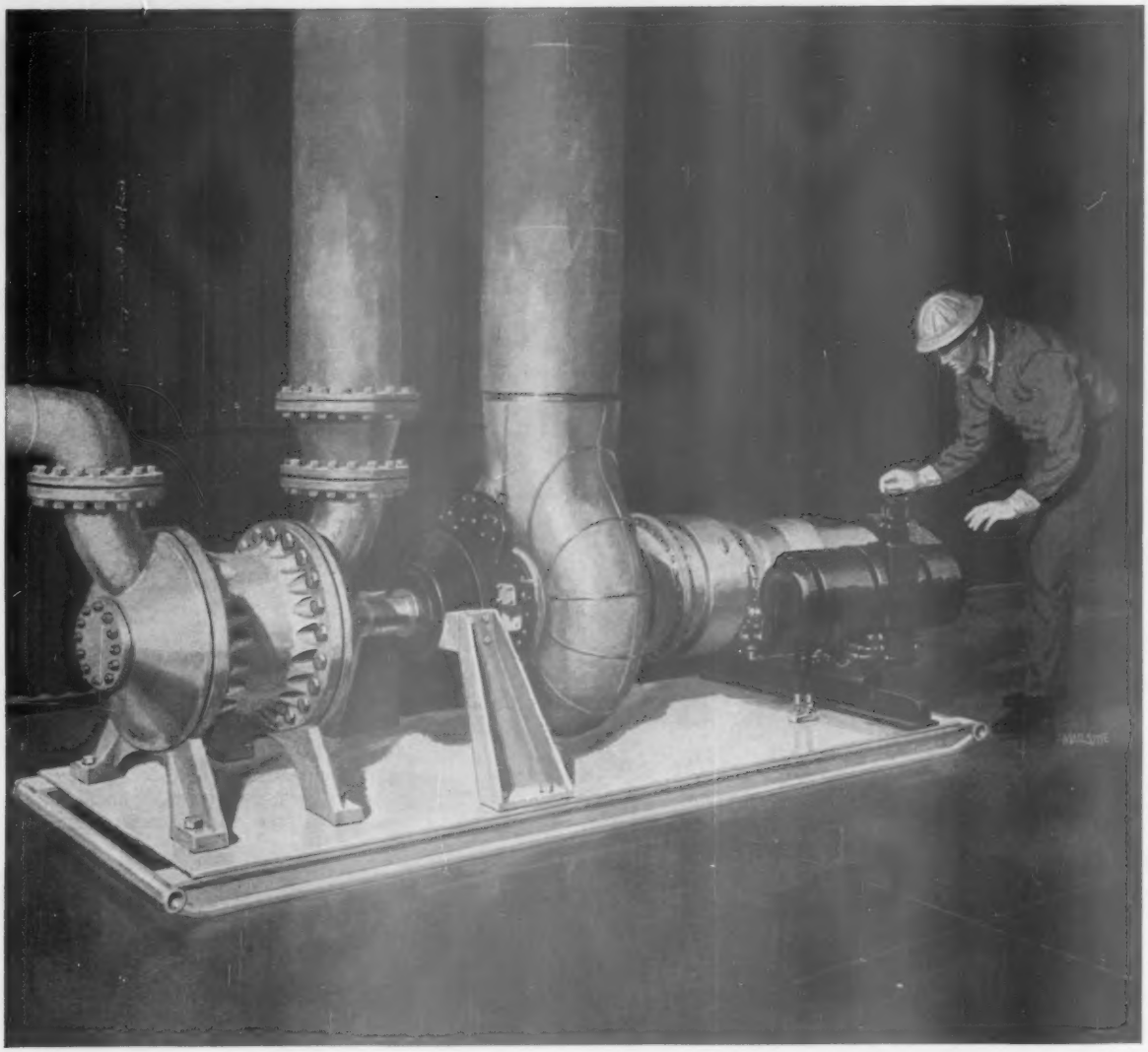


UNIQUE NEW COMPRESSOR

Solar industrial gas turbine-driven centrifugal compressor offers advantages found in no other type

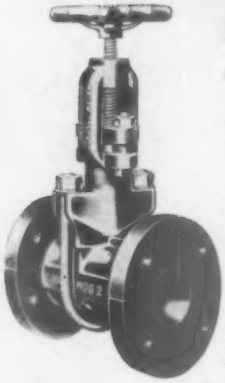
SOLAR'S LIGHTWEIGHT centrifugal compressors incorporate unique new features for applications in the low-volume range. They operate in a range of flows and pressures new to centrifugal equipment. Interchangeable compressor wheels and other parts permit quick, low-cost field changes to accommodate new flow and pressure requirements. Ideal for main pipeline stations as well as field use, they can be started or shut down in seconds—even by remote control—and are ideal for unattended operation.

Designed to match the high rotating speeds of Solar gas turbine drivers, Solar's new compressor packages are small and lightweight (a fraction of the weight of conventional piston-driven units). They require only the lightest foundations. Maintenance is simple. Easy portability allows periodic inspection at a central shop.

A new illustrated brochure describes in detail Solar centrifugal gas compressors. Write for it to Dept. G-195, Solar Aircraft Company, San Diego 12, California.

See Solar's gas turbine industrial compressor at the ASME gas turbine conference in Houston, March 6-9.

SOLAR
AIRCRAFT COMPANY



How to break the "High-Priced Valve" Habit in corrosive services

... Corrosive service once called for premium-priced valves—made entirely of stainless steel or Monel Metal. Then Lunkenheimer developed exclusive "Causul" Metal to provide "high-alloy" performance at *lower cost . . . balanced corrosion resistance* for many caustic, acid and alkaline solutions. The result has been a substantial reduction in valve costs in countless applications that formerly required premium-priced alloys. Ask your Lunkenheimer Distributor to review the corrosive problems in *your* plant. Or write the Lunkenheimer Company, Cincinnati 14, Ohio. **You can't find the cost of a valve on a price list.**

- BRONZE
- IRON
- STEEL
- PVC

LUNKENHEIMER®
THE ONE *Great* NAME IN VALVES

L-260-13

New TD-15 oil field special...

Big power, compactly for big production, easy

"Measure up" the International TD-15 Oil Field Special against all the others and you'll prove it's the big producer of the 100-hp class!

Top push-power

At your fingertip command the TD-15 gives you 20,500 lbs. of stump-grubbing, caliche-digging, rock-bossing push. The "15's" high-torque International diesel engine develops 105 hp at only 1,650 rpm—is 6-cylinder smooth!

6 speeds, coming and going

You match dozing and repositioning speeds exactly to working conditions with the TD-15's 6-speed, full-reverse transmission. Change gears and change forward-reverse directions with one fast hand-sweep of the "single stick" shift, and the Shuttle-Bar control lever.

Sintered-metal clutch efficiency

Engage and disengage the "15's" *dry type* heat-defying sintered-metal-faced engine clutch hundreds of times daily—and keep on getting the same high power-transfer efficiency, every time. And simplified clutch design also simplifies maintenance!

Dura-Roller Dependability

Exclusive International Dura-Rollers smoothly carry the "15's" work-slugging weight! These dual-protected heavy-duty 1,000-hr. lube interval track rollers are designed to roll up new economy records in "eat-'em-alive" oilfield conditions.

packaged transport!

Another TD-15 of Contractor Rumbaugh's fleet gouges out hard-packed caliche from ancient beds—stockpiles it for road surfacing on Gulf Corporation leases near Goldsmith, Texas!

Contractor Art Muller, Frannie, Wyoming, handles lots of small jobs—finds the TD-15's extra power and speed ideal to finish fast, and hurry on to the next contract. Under many conditions, the fast-working, easy-to-haul TD-15 takes care of the big jobs for them as profitably as their bigger equipment!

Pit-Fitting Blading

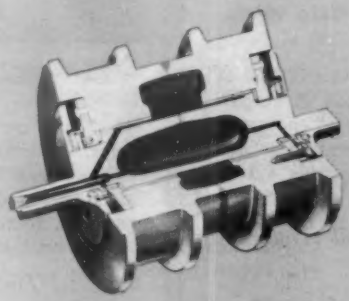
New International outside push-arm hydraulic bull-dozer concentrates TD-15 power along the 8-foot-wide cutting edge! Blade is sized to speed slush pit digging. New earthrolling blade contour, diagonal reinforcing struts and columbium-treated push arms match 'dozer strength to TD-15 power.

5-minute "move-outs!"

You get 62-inch gauge stability and maneuverability in the TD-15 Oil Field Special. Yet, maximum width (blade equipped) of only 8', and total operating weight of 26,000 live-action lbs. allow 5-minute "move-outs" by truck, day or night—without a highway permit!

'Dozing blow-sand from a Texas drill site in "grinding compound" conditions—Rumbaugh Construction Co., Odessa, "thank their stars" they've got crawlers equipped with Dura-Rollers! (This oil-field contractor owns three TD-15's!) Says V. L. Wilson, Rumbaugh's superintendent: "Powerful, compact, fast-working, clean—the TD-15 has big tractor working abilities!"

Prove the TD-15 Oil Field Special's industry-topping performance and ease of transport to yourself. Let your International Construction Equipment Distributor demonstrate!



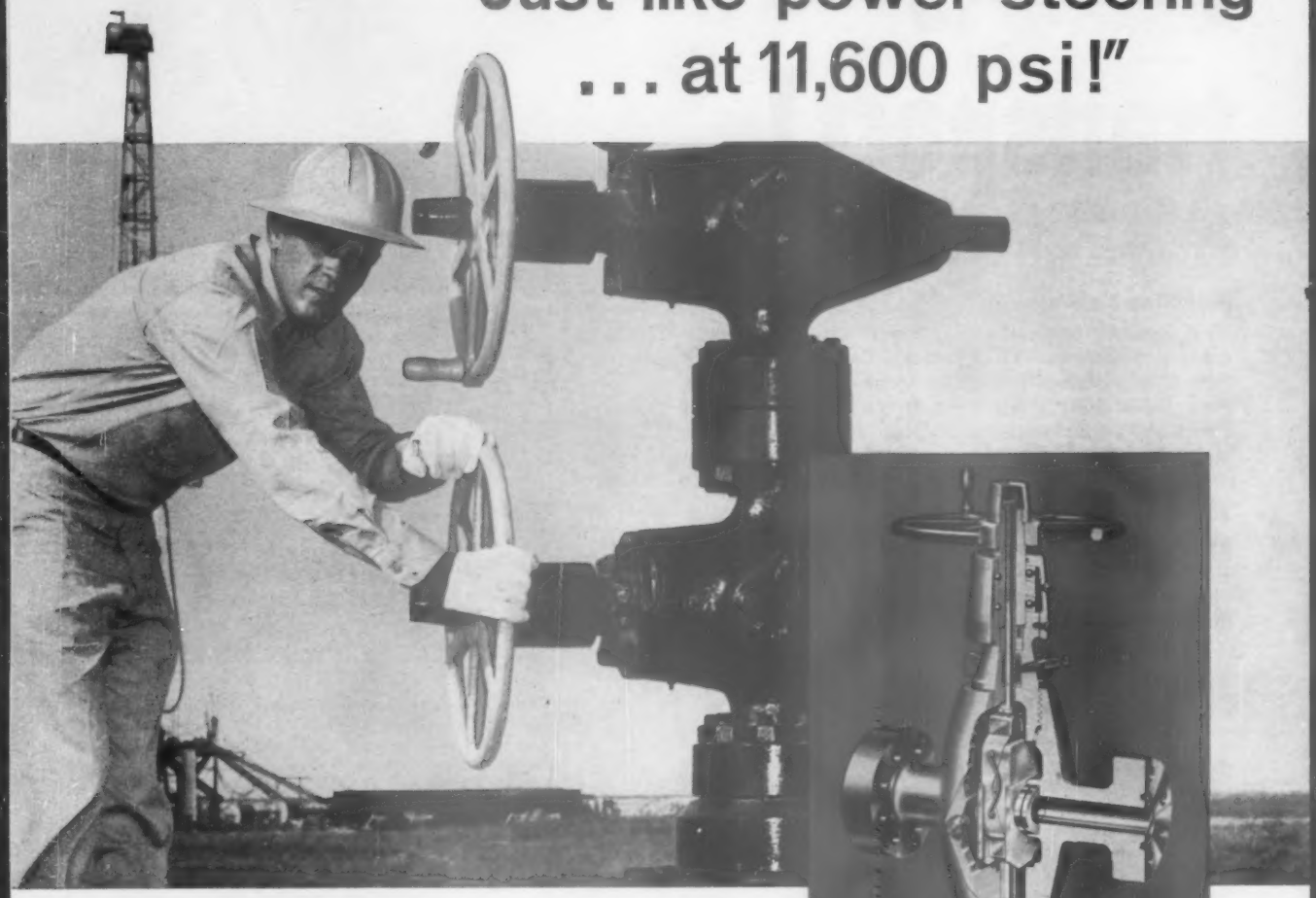
International Dura-Rollers feature the industry's thickest shells; king-sized lube reservoirs; and positive grit-exclusion with full-floating, precision-lapped seals! Exclusive pressure relief passages let you power lubricate Dura-Rollers, without affecting seal life or efficiency!

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE

"Just like power steering ... at 11,600 psi!"



W-K-M® Balanced Stem Valves

These valves are the easiest operating high pressure valves ever made.

Only W-K-M Balanced Stem Valves are designed to overcome the heavy thrust loads carried by bearings and threads in single stem valves. A second stem is attached to the bottom of the gate to balance out body pressure that acts against the operating stem. The only loads to be overcome in opening or closing this valve are packing friction and normal operating loads.

Next time — and every time — specify W-K-M! *Available at leading supply stores everywhere.*

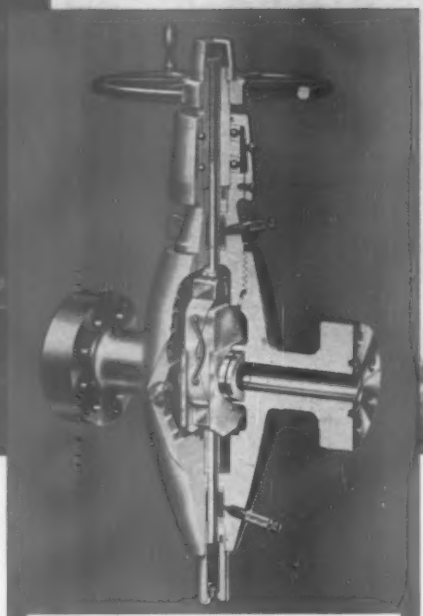
PRODUCT OF W-K-M's *Creative Engineering*

WRITE FOR CATALOG 200

W-K-M

DIVISION OF ACF INDUSTRIES INCORPORATED

P. O. BOX 2117, HOUSTON, TEXAS



W-K-M Balanced Stem Valves feature through-conduit gate construction, parallel expanding gates, controlled force seating, pressure seal bonnets, super-finished stems supported on roller bearings, seating surfaces sealed away from the lading flow.

Sizes: 1-11/16" through 2-9/16".

Working Pressures: 10,000 and 15,000 pounds.

Write for Test Bulletin WP-1058. It describes how this superlative valve successfully passed the oil industry's most punishing tests.

5912-R

Naugatuck KRALASTIC

Underground corrosion steals $600,000,000 a year!*

but KRALASTIC ABS pipe can't corrode

It can't rust or rot—is free from electrolytic action—impervious to water and the usual soil elements—highly resistant to most chemicals. Pipe made of KRALASTIC®, the original ABS rubber-resin, never needs coating, lining or anode protection.

What's more, amazingly tough KRALASTIC pipe gives a host of other advantages over conventional pipe materials.

- KRALASTIC pipe is extremely lightweight—needs no heavy handling equipment or costly bedding.
- It can be snaked through many existing lines—eliminates much time- and money-wasting ditching.
- It offers extremely low internal friction—will not accumulate scale.
- It can be quickly and easily solvent welded—by relatively unskilled workers. Or it may be threaded and used with threaded fittings.
- KRALASTIC has outstanding impact strength—even at arctic temperatures.

In short, KRALASTIC is a noncorroding pipe material with a combination of properties no other pipe material can match.

Proof of KRALASTIC pipe performance? More than 9,000 miles of KRALASTIC pipe have been specified, installed and are now in trouble-free service carrying potable water, brine, gas, a wide variety of chemicals and even electrical wire and cable. KRALASTIC pipe has been approved by the National Sanitation Foundation and is already accepted in many local plumbing codes.

Better look into KRALASTIC, the original ABS, today. Simply write on your letterhead to the address below.

*Estimate of the National Bureau of Standards

US RUBBER

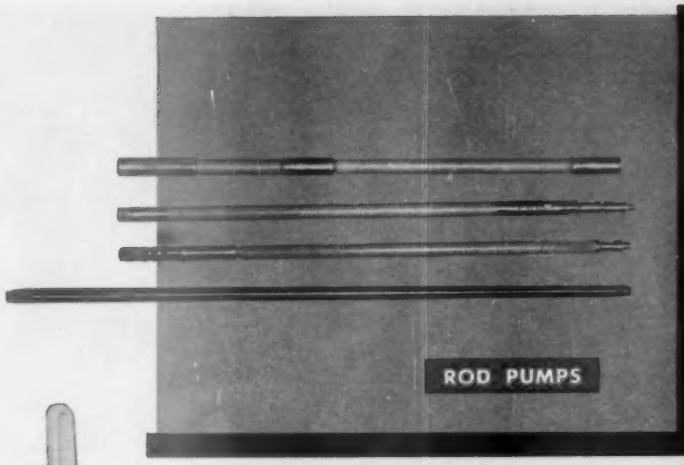
United States Rubber
Naugatuck Chemical Division
316 K ELM STREET
NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS • MARVINOL VINYLS • VIBRIN POLYESTERS

Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Phila. · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.

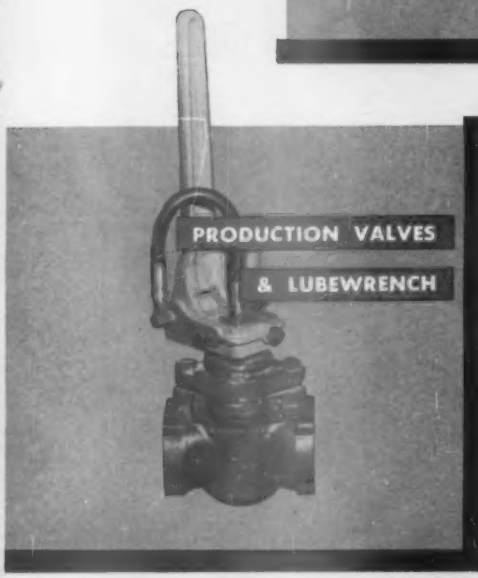
MID-CONTINENT SUPPLY CO.

SUPERMARKET for OIL INDUSTRY



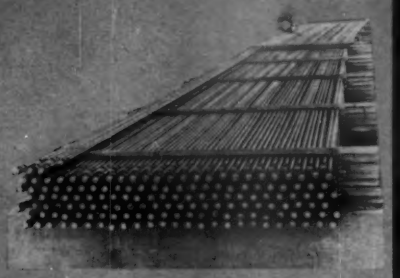
ROD PUMPS

GAS REGULATORS



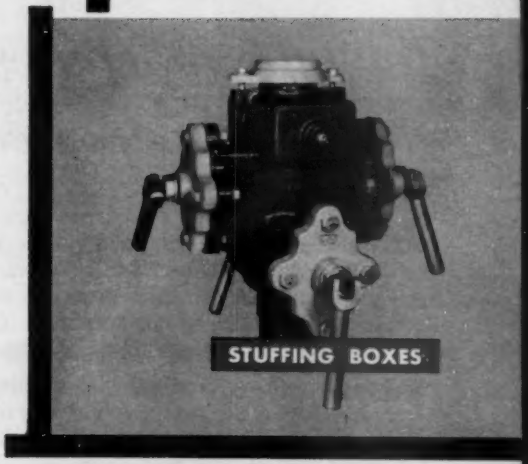
PRODUCTION VALVES & LUBEWRENCH

SPECIAL PIPE FITTINGS



SUCKER RODS

Supermarkets in the oil industry? It's one way of saying that Mid-Continent Supply Co., a vast network of field stores in the United States, Canada and South America, has everything. Mid-Continent field stores are stocked with thousands of different items needed daily in the oil fields—items of supplies and equipment with names well known and trusted for dependability and performance. Twenty-four hours a day, our "supermarkets" for the oil industry have skilled men to render top notch service and offer technical assistance. Let the neon derrick atop every Mid-Continent field store become your symbol of sure service . . . sure supply . . . around the clock . . . around the world.



STUFFING BOXES

SM2-0

MID-CONTINENT SUPPLY CO.

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Mid-Continent Building, Fort Worth, Texas • Export Division: 45 Rockefeller Plaza, New York 20, N.Y. Cable: MIDCUMPORT NYK

Teletype machines help cut costly paperwork

A Teletype machine equipped with a simple sprocket-feed mechanism can handle multi-carbon forms as readily as the more familiar plain paper on which messages are transmitted. Thus distances can be bridged not only with information, but with information that is preprocessed, ready to go to work.

Teletype printers handle a wide variety of multi-copy forms. Moreover, the usefulness of this technique can be further extended with Teletype tape punching and reading equipment—which can capture, store and utilize repetitive data to further mechanize paperwork procedures.

For more information about Teletype Model 28 equipment, please write to Teletype Corporation, Dept. 94C, 4100 Fullerton Ave., Chicago 39, Illinois.

Typing Tape Punch

Tape Reader

Send-Receive Page Printer

Automatic Send-Receive Set

TELETYPE®
CORPORATION
SUBSIDIARY OF *Western Electric Company* INC.

See Teletype Corporation's equipment exhibit at the Petroleum Industry Electrical Association Conference, April 12-14, Kansas City, Mo.

The **O·C·T**

U-65

has what you need in a . . .

TUBING HANGER

For dual or triple completions, the O-C-T U-65 Tubing Hanger has no peer in the number of advantages offered—in mechanics, economy and safety. This component part of the O-C-T Universal Tubing Head allows all strings of tubing to be raised simultaneously at completion.

But, other advantages are major. Check them:

- Simple, direct setting procedure
- Need for sleeve valves eliminated
- Completion is with tree in place
- Flange connections can be field-tested
- Complete range of sizes, working pressures

LOOK TO O-C-T FIRST FOR WELLHEAD EQUIPMENT. YOU NEED LOOK NO FURTHER.

where progress is a daily practice

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.

OCTANE RATING IS DETERMINED by running fuel samples in a single-cylinder test engine, like the one that's shown in operation.

ACCURATE QUALITY CONTROL IS EASIER WHEN STILLS ARE EQUIPPED WITH AN **AIR PREHEATER**

Average product ratings are up as much as two octane numbers at one East Coast refinery, because their Air Preheater permits maximum utility and completely accurate control of advance design units. At this refinery, the ability to control product quality accurately resulted in an extra annual income of $58,000.

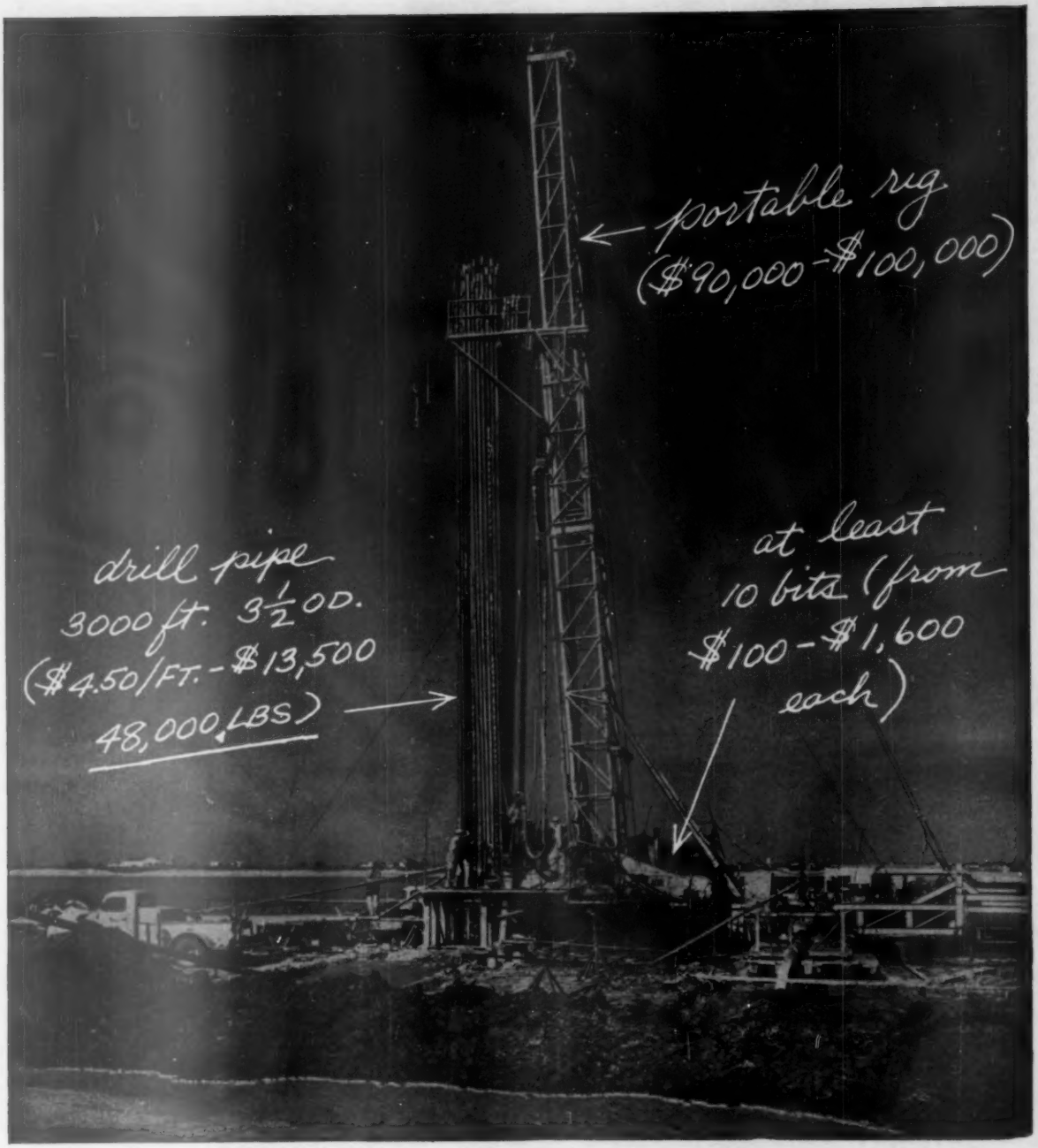
You can get continuous peak performance from the most modern heat transfer system with a Ljungstrom® gas-to-gas regenerator. A Ljungstrom can recover as much as 1000° F heat from the exhaust of stills or boilers. Instead of letting this heat escape up the stack, the Ljungstrom returns it to the furnace combustion air.

Hotter combustion air can boost the output of a pipe still, too — by as much as 25%. Or, it can cut your fuel bill by an equal amount. Some plants have "written off" the cost of their Ljungstrom in 9 months.

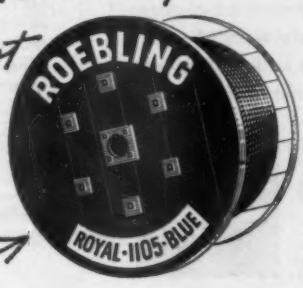
Here's documented evidence. One company's fuel savings with a Ljungstrom Air Preheater are factually described in a published magazine article by O. F. Campbell. A reprint of this case history is yours free. Simply write to Air Preheater Corp.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.



When you spend $90,000 for a drilling rig you've got to use the best rope available →



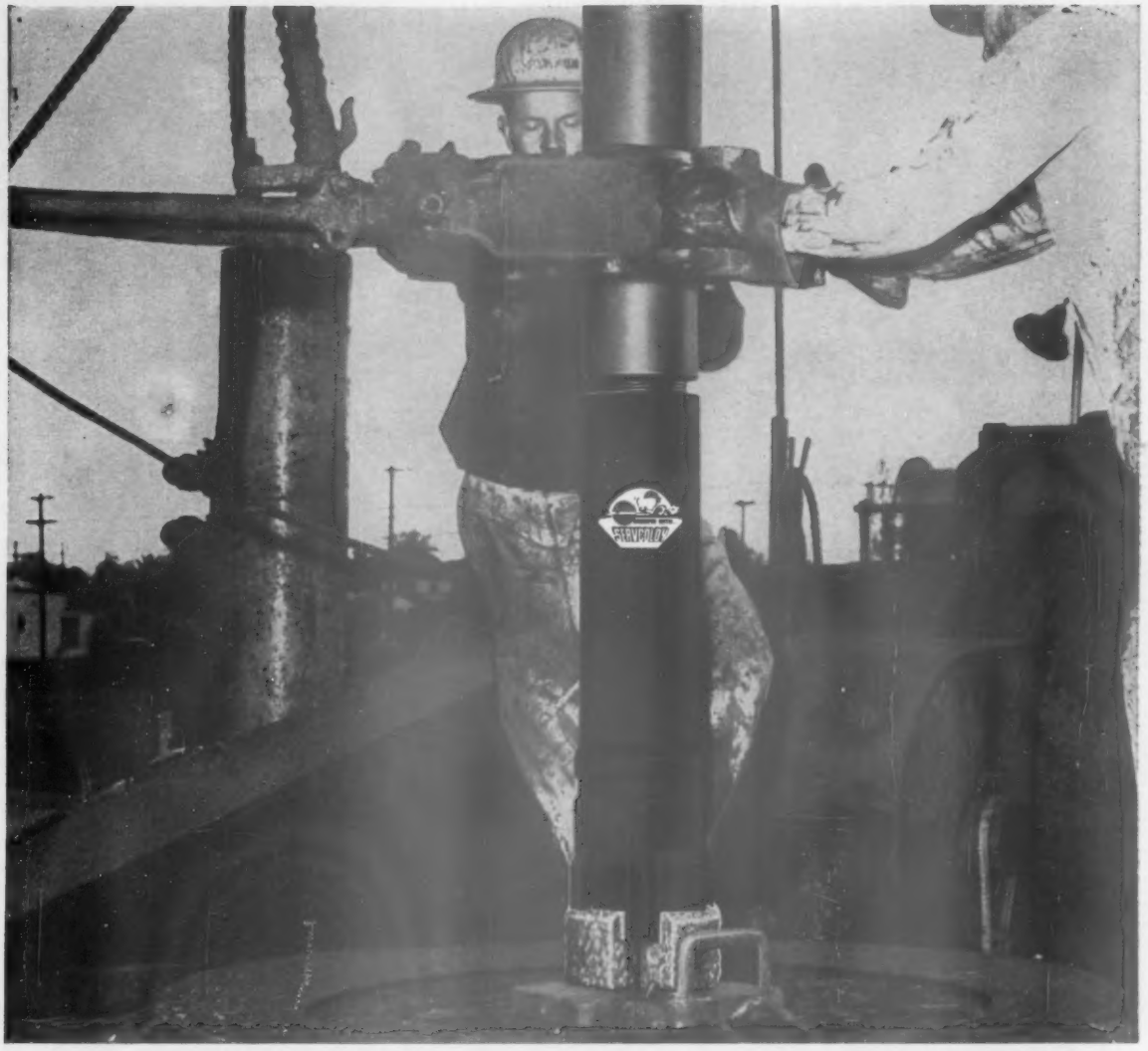
The best long-run, moneysaving rope. The high cost of portable drilling rigs excludes the "wise" buying of any rope below the quality level of Roebling Royal Blue. Anything less will cost you *more*, in replacements, delays, frustration.

Royal Blue is a product of America's oldest wire rope manufacturer. It is made from the toughest rope wire ever produced—Type 1105—extra high-strength improved plow steel. Preformed Royal Blue has a flexibility that curves around replacement costs and leaves them dormant. It is the strongest wire rope you can buy and use . . . for a long time.

You need exceptional resistance to shock, abrasion, fatigue and impact. You need around-the-clock ruggedness. Your Roebling distributor has what you need—Roebling Royal Blue. Get it and save. Wire Rope Division, John A. Roebling's Sons, Trenton 2, New Jersey, will send you details. Write.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation



Three 6⅛" Bit Cones milled up in 2 HOURS!

Servcoloy-dressed Junk Mills chew up bit cones and other junk with amazing speed; makes this method of removing a fish fast, safe, and very economical.

After three cones from a 6⅛" bit were left on bottom, two rock bits, two hydro-bailers, and two junk baskets were run during a three-day period in attempts to either recover or sidetrack the three cones. Results were negative.

A six-inch Servco CJ Junk Mill dressed with Servcoloy, was then run in the hole. A total of two feet of hole was drilled in a period of two hours of milling. The operator ran back with a bit and proceeded to drill a head. Fine steel cuttings were caught on the shaker during the milling and appeared on the mud screen during the succeeding day, showing that the *cones were actually milled up, not sidetracked.*

Other operators running the Servco Junk Mill report similar results. The astonishing cutting properties of Servcoloy have completely changed thinking about down-hole milling. Why not get complete information from your nearest Servco office?

WHAT IS SERVCOLOY?*

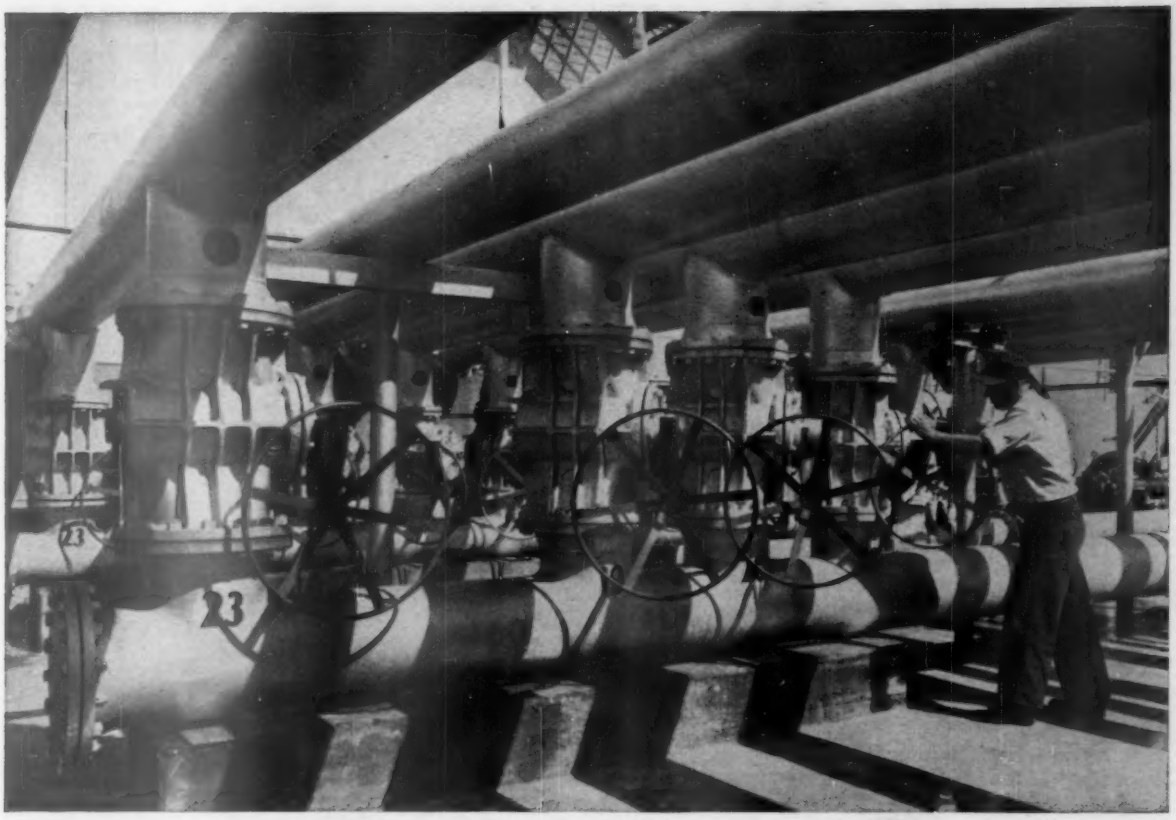
Servcoloy is a patented, hard-facing material which uses a unique method of suspending bits of carbide in a tough, elastic matrix. As the carbide cutting edges are worn away or torn from the matrix, new edges are automatically exposed. Servcoloy is now being used on Servco milling tools such as section mills, rotary shoes, taper mills, pilot mills, etc. Remedial work which formerly took days to do is now being done in hours.

SERVCO

General Offices: 2440 Cerritos Ave., Long Beach 6, California
Gulf Coast and Mid-Continent: 4850 Gasmer Street, Houston 35, Texas
Canada: 6909 - 104th Street, Edmonton, Alberta **Venezuela:** Maracaibo

Field Offices: Ventura, Bakersfield, Lafayette, Harvey, Oklahoma City

*U.S. Patent No. 2,833,638

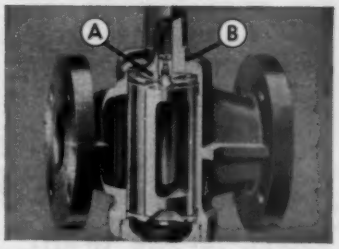


When it comes to quick, efficient control of petroleum products . . .

these Homestead® Lubricated Plug Valves handle 2,000,000 barrels a month!

At the West Coast marine terminal shown above, the tremendous flow of gasolines and oils from storage and tankers demands smooth, positive operation at all times. For this reason, 33 Homestead Lubricated Plug Valves in sizes from 8″ to 16″ were specified for this installation.

Today more and more oil companies specify Homestead Valves for their dependable, maintenance-free performance and built-in engineering advances. For example, *100% pipe area* reduces ship loading and unloading time. *Pressurized chemical seal* and closely fitted plug and body assure positive shut-off, no mixing of different fluids. *Controlled lubrication* provides full coverage of sealing surfaces without contamination of line fluids. *Quick operation* . . . Homestead Valves are fully opened or closed in a quarter turn of the plug.



Cross-section of Homestead Lubricated Plug Valve. Triple head seal (A) prevents leakage. Tell-tale lubricant ring at (B) signals full system, prevents waste of lubricant and contamination of line fluids.

For complete details and valve recommendations for *your* application, mail coupon below.

hv

HOMESTEAD VALVE MANUFACTURING COMPANY
Coraopolis, Pennsylvania

Homestead Valve Manufacturing Co.
P.O. Box 406, Coraopolis, Pa.

Gentlemen:
Please send reference books on Homestead Lubricated Plug Valves and their uses.

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

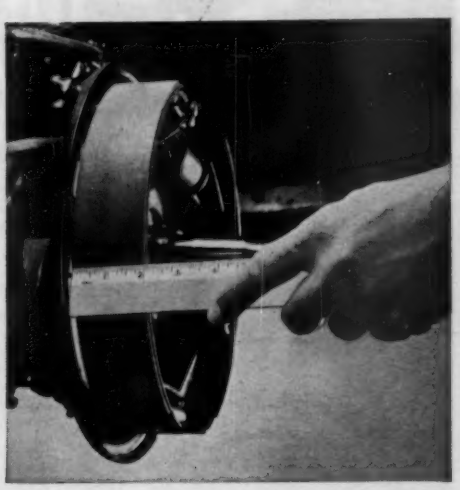
CHEVY'S BIG NEW BUILD IS LIKE

Here are some of the many ways in which Chevrolet's totally new build for '60 will work to build a bigger bank account for you. They show that a '60 Chevy means profit, through longer life, less maintenance, easier working, outsized cargoes and extra economy!

Major components of a 1960 Chevrolet truck last up to four times longer than ordinary truck parts – exhaustive testing has proved it. Likewise, the totally new cabs have proved 67% more resistant to twisting; and new frames for many models are as much as eleven times stronger in torsional rigidity. These are typical 1960 Chevrolet truck facts and figures – and they point up a new kind of tough truck build that helps you hang on to your dollars. And consider these '60 Chevy features from a profit-boosting standpoint:

MONEY IN THE BANK FOR YOU!

New torsion-bar independent front suspension saves maintenance, increases work output. Independently suspended front wheels step right over bumps; tough torsion bar springs soak up shocks. As much as 78% of all objectionable road shock is absorbed before it reaches truck body, sheet metal or driver! And the smooth ride saves time on rough roads; means more work per day.



New Chevrolet brakes are bigger; better at bringing a loaded truck to a safe, sure stop. And the extra-wide lining wears longer – helps reduce maintenance expense. You get the best in braking in every Chevy; in light-duty models, tough torque-action brakes are extra efficient.

New Chevy frames with new do-the-job brawn. Box-section rail design is stronger than ever; rail section modulus has been increased as much as 33%. And massive box-section front crossmember adds to truck stamina; helps keep you going years longer at least expense. New drop-frame construction lowers truck height; makes cab entry and truck loading easier.

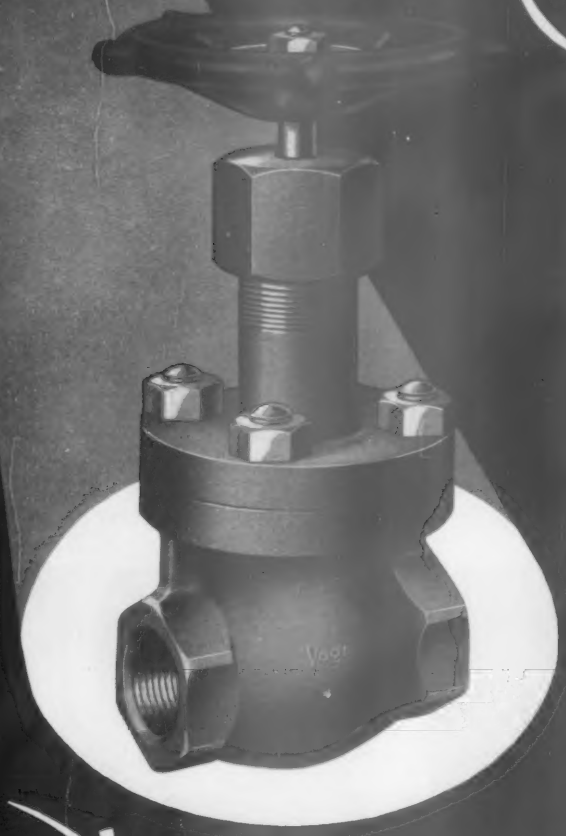
Precision-balanced wheels. This small balancing weight indicates that all Chevrolet truck front wheels are balanced in assembly – an advantage no other truck offers. It's assurance that Chevy handles easily and safely; that tires will last longer without shimmy and shakes from wheel imbalance.

Chevy's big new full-width hood and low-profile fenders make underhood components more accessible; servicing is faster and easier. New frictionless coil springs in the rear effectively soak up road shocks before they reach the frame. You'll find, too, that 1960's savingest truck power is Chevrolet's: famous economy 6's and efficient short-stroke V8's for light-duty models . . . high-power, high-torque V8's and tough, dependable 6's for the bigger trucks. It'll profit you to see your Chevrolet dealer about Chevy's big new build, sometime soon. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

1960 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET

Spotlighting 2 NEW VOGT VALVES



★

FORGED STEEL

INSIDE SCREW

Bolted Bonnet

GENERAL GP PURPOSE

GATE and GLOBE

VALVES

150-800 Pounds Service

2000 Pounds Cold, W.O.G.

Available from stock in ¼" thru 2" sizes and in both socket weld and screw ends.

CHECK THESE FEATURES

1. Forged steel pressure containing parts designed for light weight and brute strength.
2. Hard faced seats and hardened discs and wedges.
3. Spiral wound stainless steel or Monel gaskets to suit trim.
4. Extra deep stuffing box for long packing life.
5. Dished sure-grip handwheel.

Write for literature Dept. 24A-FO

HENRY VOGT MACHINE CO., LOUISVILLE, KY.

SALES OFFICES

New York, Chicago, Cleveland, Dallas, Camden, N.J., St. Louis, Charleston, W.Va., Cincinnati

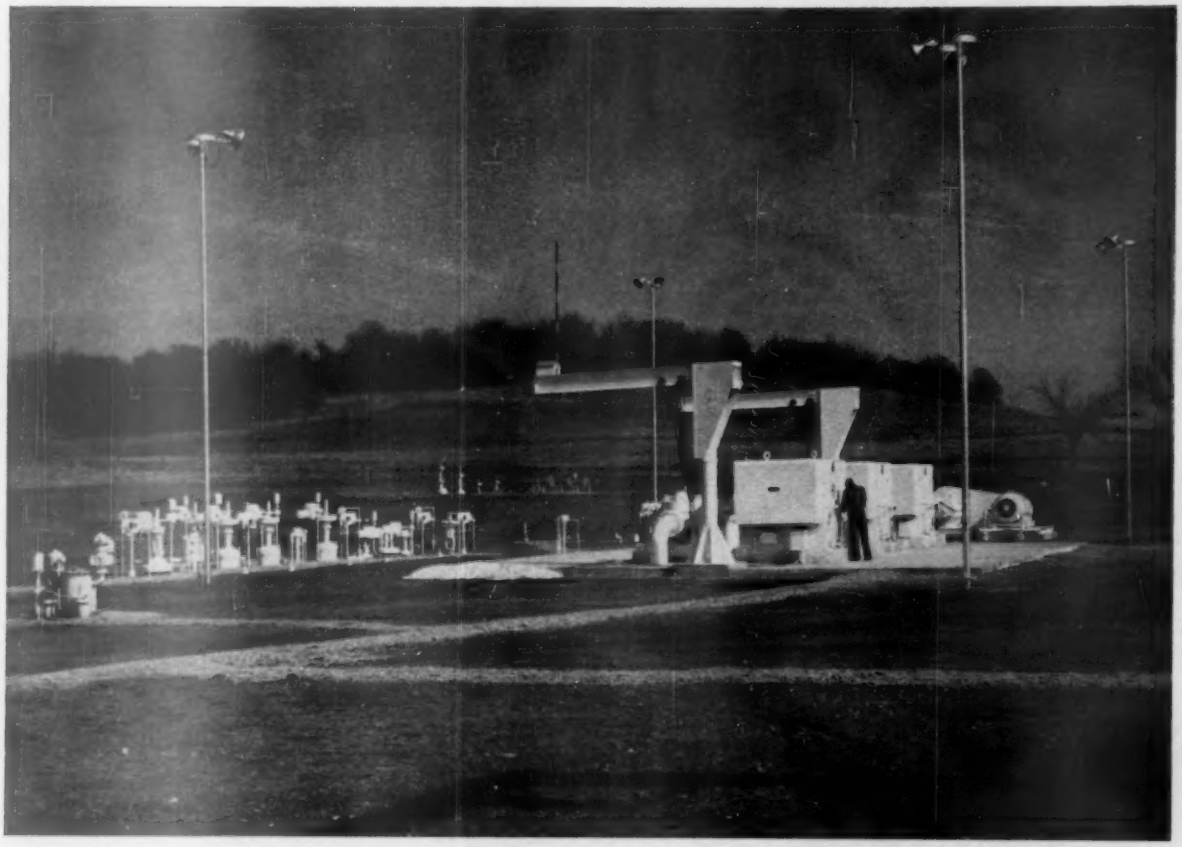
Vogt GENERAL GP PURPOSE Vogt FOR BETTER VALVES & FITTINGS

FORGED STEEL

VALVES

You can depend on purchased electric power for

REMOTE CONTROL



Remote-controlled crude station with three 1250 hp and one 200 hp electric motors

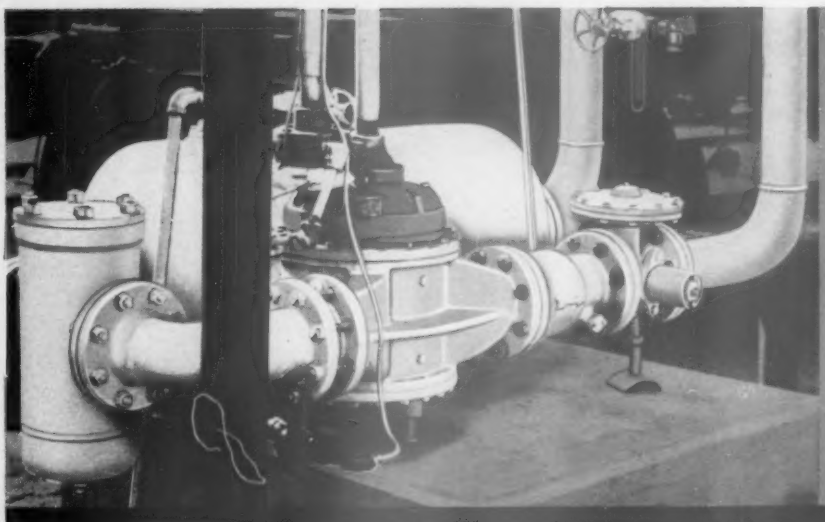
This remote-controlled crude station is typical of the modern trend in electrification. In addition to the four electric motors, the valves and sump pump are all controlled from a town some distance away. This installation is dependably served with utility electric power and a fine example of adaptability of purchased power to remote control.

For pipelines, as well as for producing fields and refineries, you can always depend on utility electric power. See your nearest utility electric power company for assistance or write the Petroleum Electric Power Association.

Purchased Electric Power . . . saves money, manpower, maintenance, and serves you better automatically

Petroleum Electric Power Association P.O. BOX 35006. DALLAS 35, TEXAS

Continental Oil



SPECIAL PRODUCT LOADING
Three-inch S-35 Smith-Erie Meter assemblies equipped with temperature compensators, set stop valve, strainer, set stop mechanism and barrel counter. Printed meter ticket checks reading against refinery production.

LOADING TERMINAL
Approximately 30 Smith-Erie meters are in service loading products into trucks of Continental's customers, and tank cars for rail shipment. These meters are equipped with temperature compensators, deaerators, flow rate control valves, set stop mechanisms delivering gross gallons and printed tickets.

At Denver Terminal, separate Smith-Erie meter systems keep accurate accounting of all sales and transfers

Knowing the ins and outs and knowing them *exactly* is a must at complex product refinery-loading installations such as this one operated by the Continental Oil Company. Small wonder this progressive company "counts on" Smith-Erie meter systems for precise accounting of every drop of finished petroleum product regardless of operating conditions.

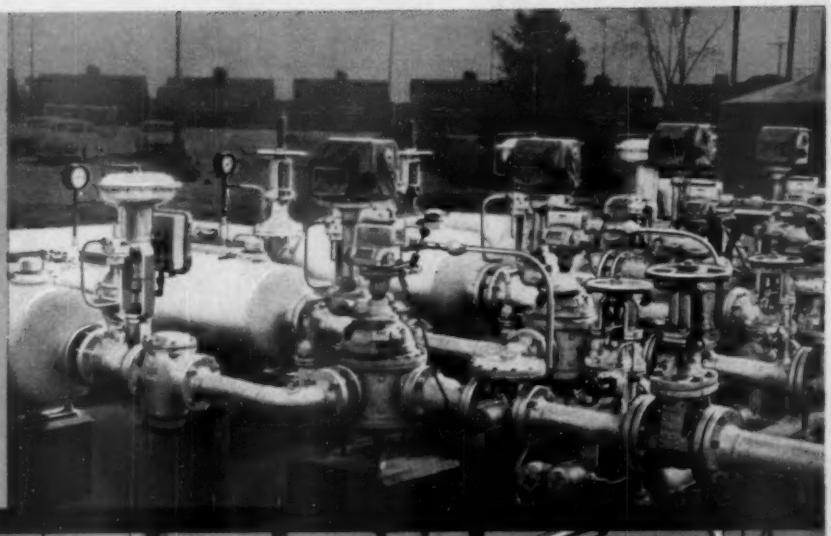
At Continental, knowing the ins and outs has a double meaning. Here, two separate operations go on simultaneously. One is intra-company distribution of the product from refinery to Continental trucks. The other is an out-sales situation involving transfer of product from refinery to trucks owned by Continental's customers. In both cases, Smith-Erie meters save costly manpower . . . provide for direct throughput . . . cut evaporation losses.

This Denver terminal is just one example of how Smith-Erie metering systems measure up to the most complex terminal requirements. For more information, contact your A. O. Smith meter man or write direct.

meters every drop

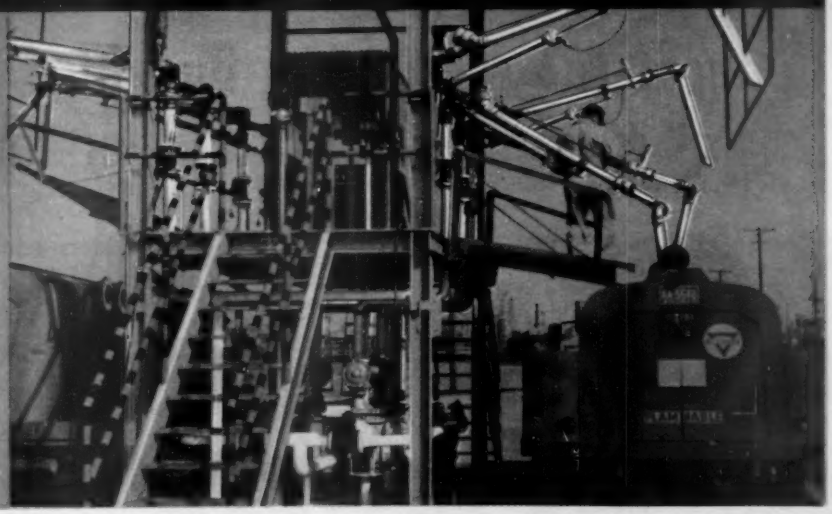
MARKETING STORAGE

Two Smith-Erie AS-35 and two AS-50 meter assemblies measure finished products from refinery production into tanks for Continental's own marketing division. Meters are equipped with temperature compensators, gross and net counters, set stop valves, deaerators and strainers. Readings are checked against refinery production and retail deliveries.



MARKETING DELIVERY

Four Smith-Erie AS-35 meters with accessories record loading of finished petroleum products into Continental trucks for delivery to Continental stations. This completes accurate record between manufacturing (refinery production) and deliveries against sales. Meters account for every drop and print a temperature-corrected record — automatically.

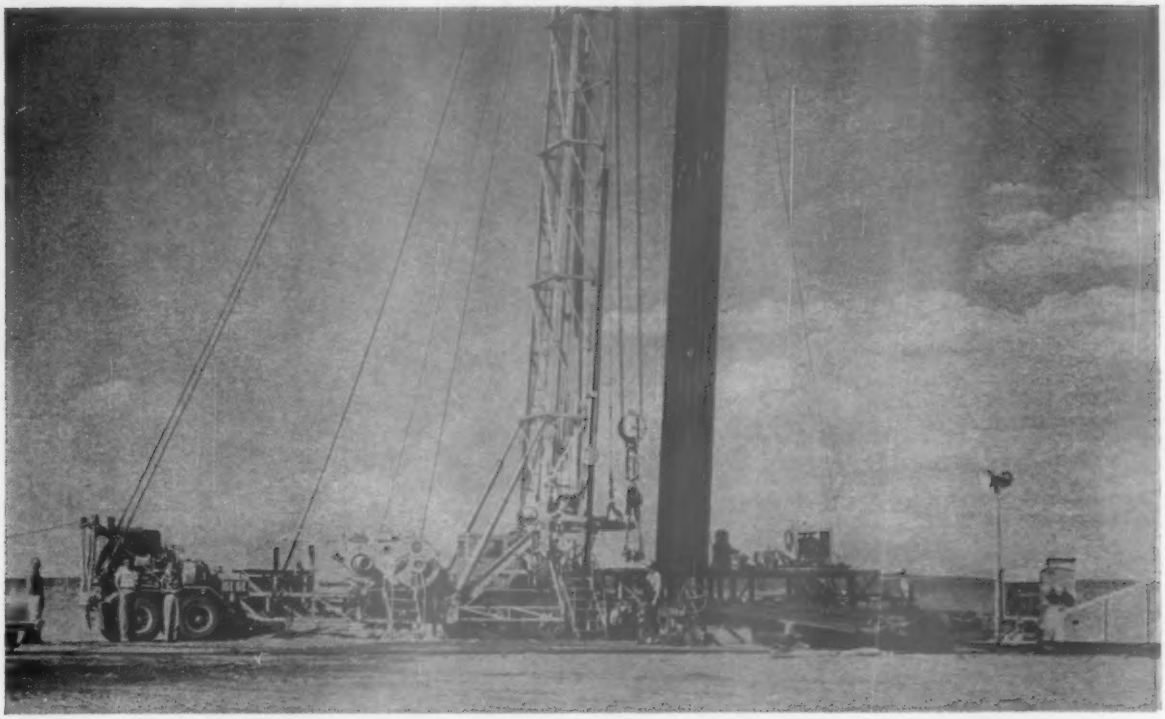


Through research ... *a better way*

A.O.Smith
CORPORATION
Smith-Erie Division

Factory: 1602 Wagner Ave., Erie, Pa. Offices: Atlanta 5, Ga.; Chicago 3, Ill.; Houston 2, Texas; Los Angeles 22, Calif.; New York 17, N. Y.; Oakland 21, Calif.; Tulsa, Okla. Canada: Toronto 12, Vancouver 1. A. O. Smith International S. A., Milwaukee 1, Wis., U.S.A.

Better products, *faster*, from your Federal-Mogul jobber:



Federal-Mogul Engine Bearings keep power at a peak to drill deeper and faster

Today's modern equipment deserves the service and dependability that only Federal-Mogul Engine Bearings can give

When you invest in costly drilling equipment, you expect to get peak performance and ultimately, more profits. Whenever you overhaul your power, it's always good practice to install the finest bearings obtainable. Otherwise, rebuilding can be costly. Federal-Mogul engine bearings are precision-made to keep engines delivering peak power longer—over the road or in the fields. They're made to take hard work under all conditions. No wonder they're the first choice of skilled mechanics in oil fields all over the world.

Your nearby Federal-Mogul jobber will welcome your call and he'll see that you get fast delivery on these longer lasting, quality bearings. Call him today.

FEDERAL-MOGUL ENGINE BEARINGS

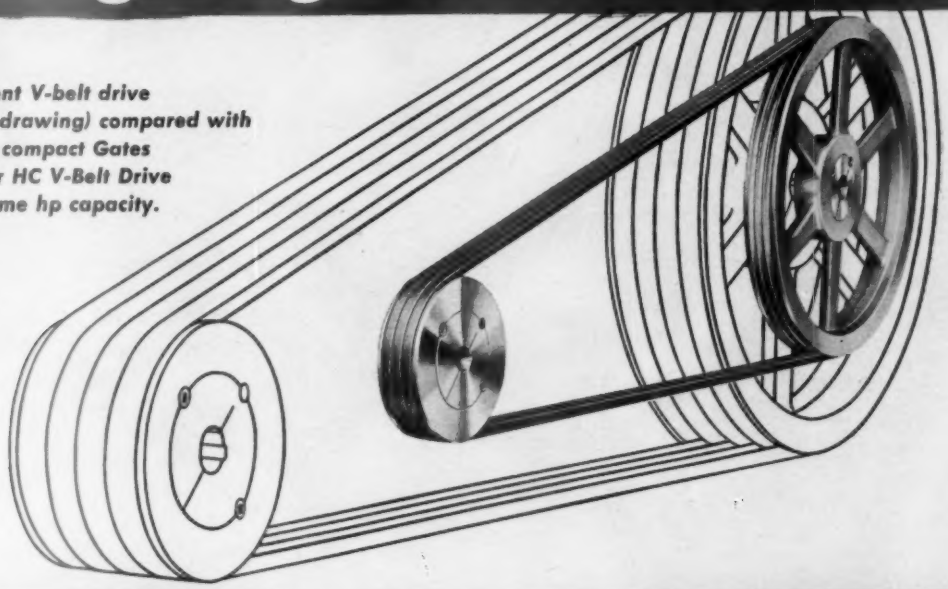
BEARING FEDERAL Mogul SERVICE

FEDERAL-MOGUL SERVICE

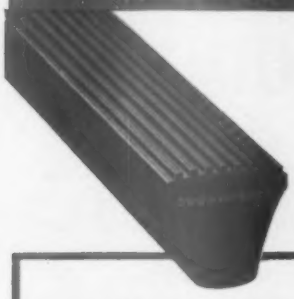
DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

Designing NEW DRIVES?

Present V-belt drive (line drawing) compared with new, compact Gates Super HC V-Belt Drive of same hp capacity.



COMPARE: Left, typical drive with present V-belts. Right—drive of same hp capacity with Gates new Super HC V-Belts . . . uses fewer belts, smaller sheaves and shorter center distance.



For NEW drives on mud pumps Gates compact new Super HC V-Belt with the patented ribbed top cuts space required up to 50% and cost as much as 20%.

Gates

World's Largest Maker of V-Belts

Save up to 20%

with new high capacity V-belt drive

When you change the whole drive — on mud pump, pumping unit, or any other piece of petroleum equipment — remember: The cost of a Gates Super HC V-Belt is as much as 20% less than the cost of present V-belt drives of the same horsepower capacity.

A development of Specialized Research in the world's largest V-belt laboratories at Gates, the new Super HC V-Belt makes possible the most compact, lightest-weight, lowest-cost multiple V-belt drive you can put on any pump!

Cuts drive space as much as 50%

With Gates new Super HC V-Belt, sheave diameters and widths can be reduced 30% to 50%, center distances 20% and more. Bearing load is lightened and total space occupied by the drive may be cut as much as 50%.

"The Modern Way to Design Multiple V-Belt Drives" is an informative handbook on the Super HC Drive, available from your nearby Gates Distributor listed in the Yellow Pages of your phone book.

The Gates Rubber Company, Denver, Colorado
Gates Rubber of Canada Ltd., Brantford, Ont.

TPA 439B

Gates Super HC V-Belt Drives

Handy, tough and economical!

Dig deep and fast with the International 340 Utility and low-cost International Wagner No. 65 backhoe. Maintain trench grades down to 10 feet anywhere in a 180-degree arc. The 340's giant-capacity 17 gpm internal-mounted pump allows for operation of up to four hydraulic control levers simultaneously.

**Maximum flywheel horsepower at standard sea level conditions.*

You get big tractor brawn on a budget with the rugged, dependable International® 340 Utility! While rated in the economical 45 hp class, the 340 has the built-in weight and strength usually available only with larger, more costly tractors.

Match speed options to your jobs. Choose Fast-Reverser for five speeds reverse on shuttle-type operations. Or, select 10 speed Torque Amplifier drive . . . in any gear, just pull the TA lever to boost pull-power up to 45%, *on-the-go!*

Get proof in performance at your nearby IH dealer's. See how hefty Internationals put a work-speeding punch in heavy trenching. See how International power and traction boosts output with loaders. Ask about the full line of Internationals from 13.4 to 95 hp*.

See your INTERNATIONAL HARVESTER dealer

International Harvester Products *pay for themselves in use*—Farm Tractors and Equipment . . . Twine . . . Industrial Tractors . . . Motor Trucks . . . Construction Equipment—General Office Chicago 1, Illinois.

This Darling gate valve feature can help you

KEEP UP THE GOOD WORK!

Darling fully revolving double disc gate valve, gear operated, at crude oil pumping station.

Almost all gate valves start out doing a good job. But it's very doubtful if *any* others can match Darlings for prolonged easy closure and freedom from downtime.

It's largely the Darling *fully revolving double discs with parallel seats* (shown above) that make the difference! This principle minimizes friction and uniformly distributes whatever wear there is. What's more these valves can "live" with the line stresses and surges that cause other valves to fail.

Why not get more familiar with how these Darling valves perform and what they offer you in avoiding trouble and downtime? Simply ask for Catalog No. 57.

DARLING
DARLING
VALVES

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Jim Weaver, who supervised construction of new type chlorine and caustic soda tank cars, says you'll like doing business with Columbia-Southern

Jim Weaver and other members of Columbia-Southern's Traffic Department have pioneered a long list of improvements in the safe and economical shipping of chemicals. The company's new fleet of tank barges incorporates many special features designed for more efficient handling of bulk quantities. Columbia-Southern's liquid caustic tank cars were the first to use a special lining that permits delivery of high concentration caustic—free from metallic pickup. Also, Columbia-Southern developed the use of the dome safety platform on tank cars, as an effective safeguard against accidents during loading and unloading.

This *customer-oriented* attitude is common to all Columbia-Southern activities. For example, Columbia-Southern caustic soda is available in a variety of forms and grades, providing each customer with the particular caustic best suited for his facilities and needs. Customers can choose from solid, flake (in fine or medium particle size), or liquid (in 50% or 73% concentration). In addition, there's a highly purified grade of liquid caustic, for special uses such as rayon manufacture. And your Columbia-Southern Technical Service Representative is always available for professional consultation on the proper application of these various forms of caustic soda.

Buyers of chemicals in every industry like this thoroughness, because it adds up to extra profits for them. You'll find that it will for you, too.

Anhydrous Ammonia, Barium Chemicals, Benzene Hexachloride, Calcium Chloride, Calcium Hypochlorite (Pittchlor®, Pittabs®), Carbon Tetrachloride, Caustic Potash, Caustic Soda, Chlorine, Chlorinated Benzenes, Chloro IPC, Chrome Chemicals, Hydrogen Peroxide, Muriatic Acid, Pacific Crystals, Perchlorethylene, Rubber Pigments (Calcene®, Hi-Sil®, Silene®), Soda Ash, Sodium Bicarbonate, Sodium Sulfate, Titanium Tetrachloride, Trichlorethylene

columbia southern
CHEMICAL CORPORATION

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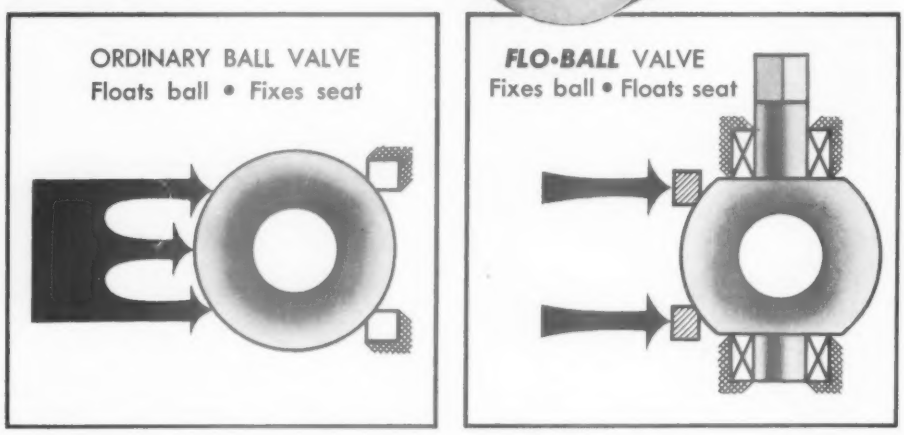
Only *FLO•BALL* valves are "Bearing-Fixed" for maintenance-free long life!

...with all the features you must have:

- **Top loading**
- **Replaceable seats**
- **One-piece ball and stem**
- **90° on-off**
- **Two-way flow**



Floating ball puts excessive pressure load on fixed seats. Results in distortion and short life.

***FLO•BALL* bearings absorb all pressure forces. Elimination of excessive seat loading insures long life.**

The ***FLO•BALL*** is available at mass-produced prices in all materials and sizes through 10" in 150 lb. and 300 lb. class. Write today to Hydromatics for full information on this extraordinary valve.

FLO-BALL

Hydromatics, Inc.

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Exceptional engineering employment opportunities—write today!

News! The best features of
modern bearing design combined and refined in

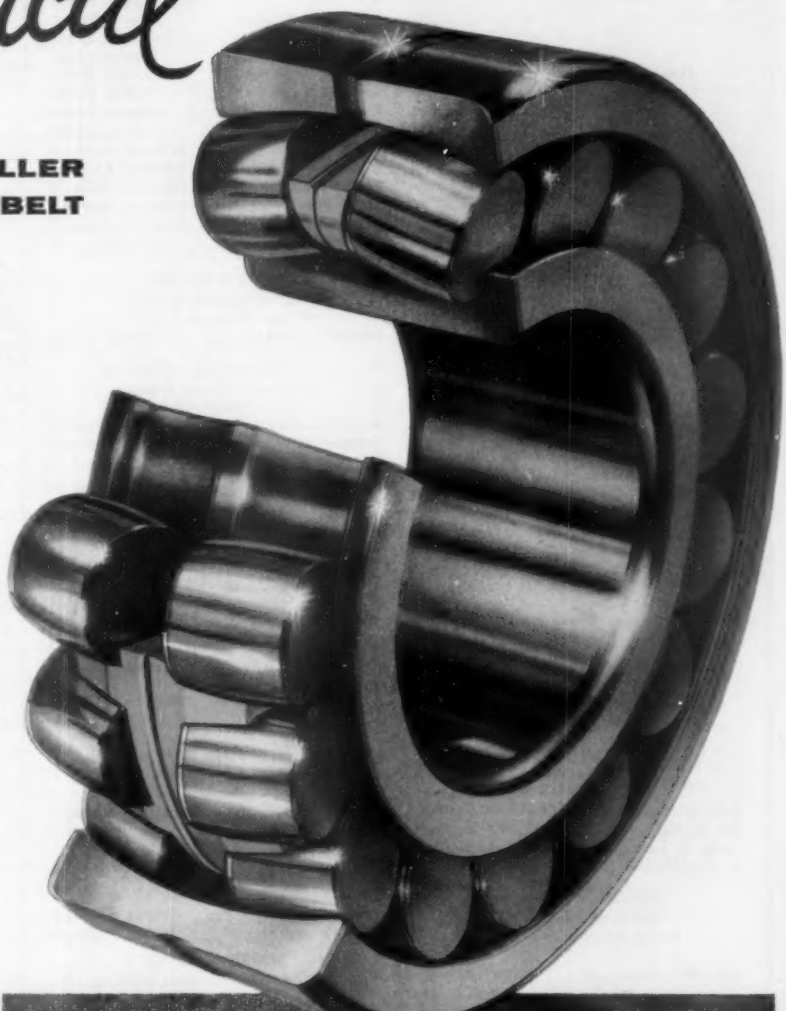
Spherical

SELF-ALIGNING ROLLER BEARINGS BY LINK-BELT

BIG, mirror-smooth convex rollers *plus* heavy, broad-shouldered inner race *plus* centrifugally-cast bronze, precision-machined retainers! Only from Link-Belt do you get ALL that is best in modern bearing design.

Individually, these elements represent major improvements on accepted design concepts. Collectively, they constitute the most efficient spherical roller bearings available . . . promise unequalled economies, whatever the application.

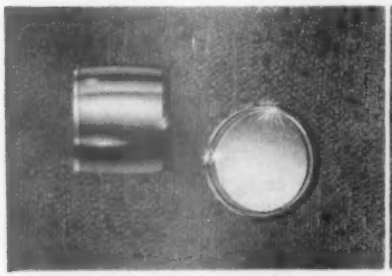
Your Link-Belt office or authorized stock-carrying distributor will gladly explain the many performance advantages evolved with this new design. And either can furnish full data on industry's most complete line of ball and roller bearings . . . pillow blocks and flanged, flanged-cartridge, cartridge and take-up blocks.



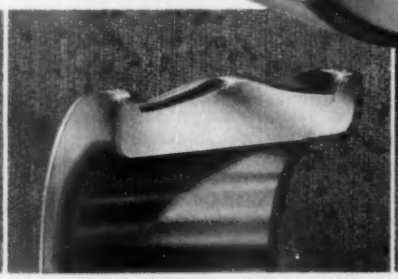
LINK-BELT

MANUFACTURERS OF SELF-ALIGNING BALL AND ROLLER BEARINGS

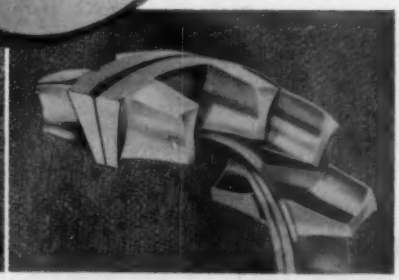
LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 14.819-B



BIG, HIGHEST-CAPACITY ROLLERS. Each bearing has a maximum number of rollers —as large as possible, yet all components are in optimum balance.



HIGH, HEAVY INNER RACE FLANGES present convenient hold for assembly and removal of bearing without cutting away shaft, avoid any need to skimp on shaft shoulders.



PRECISION-MACHINED, CENTRIFUGALLY-CAST BRONZE RETAINERS have many times more support and ability to withstand high stress. They are not stampings. Design assures maximum bearing efficiency.

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They Say—

Mixed identities

Dear Sir:

I would like to call your attention to an error in the title of the article authored by me on prevention of metal contamination in British American's refineries (OGJ, Feb. 15, p. 107).

The title should read "B-A's Cat Crackers Get Clean Feed," instead of "BP's Cat Crackers Get Clean Feed."

Robert J. Hood
British American Oil Co., Ltd.
Toronto

(Editor's note: The title was in error . . . obviously we weren't minding our P's and A's, and, unfortunately, that wasn't all that was wrong with this story. See below.)

And furthermore . . .

Dear Sir:

"P" for "A" makes big difference in heading . . . also, flow sheet has nothing to do with the paper.

Jack Yocom
British American Oil Co., Ltd.

(Editor's note: This article was jinxed! The B-A flow sheet appeared in the February 29 issue, p. 80, in an article titled "New Catalyst Converts Higher Percentage of Ethylene in Making Ethylbenzene" by Edwin K. Jones, Universal Oil Products Co. And, you guessed it, the flow sheet appearing with the B-A article belonged with the UOP story. These two articles were prepared for printing at the same time and the charts were accidentally switched. Our apologies to all concerned.)

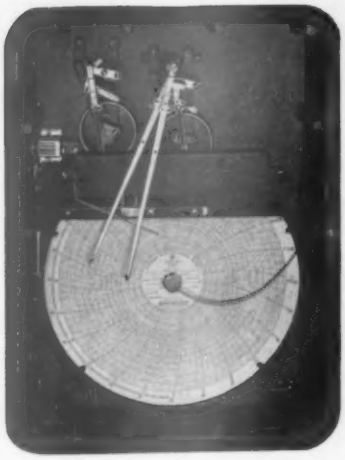
It had a good tone

Dear Sir:

Congratulations on the Journal's excellent report on coal and the national fuels policy furor! (OGJ, Feb. 15, p. 62).

This tone was a welcome change from the usual we have been getting from our own industry.

A few more facts and a little less prejudice might stand us all in good stead in the long run. Strangely, the companies and organizations in our industry which characteristically insist on hearing both sides before sounding off have been in the forefront of efforts to present the impression that the coal industry is in all respects a



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Single, double and duplex-integrating models available in a wide range of manometer types and working pressures. Dust-proof, die-cast aluminum cases... Gasclok and electric instrument chart drives. Also supplied with American Telecounter for remote readings.

Ask for Bulletin 401 for complete details.

AMERICAN® METER COMPANY
INCORPORATED ESTABLISHED 1836
General Offices: Philadelphia 16, Pa.
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mortal enemy of the oil and gas industry.

It's not too soon for somebody to point out that there may be another side worth at least noting.

W. E. Turner
Executive Vice President
Texas Independent Producers and Royalty Owners Association
Austin

GE antitrust suit

(Editor's note: The following statement was made by Ralph J. Cordiner, chairman, General Electric Co., after GE's indictment by a Philadelphia Grand Jury on an antitrust violation charge.)

"General Electric has a written company policy regarding compliance with antitrust laws that has been in effect since 1946. This policy has been reemphasized several times since 1946, and goes further than the antitrust laws require.

"It is part of the business code by which General Electric employes must live, and reflects our determination to maintain a standard of business ethics in this company which will be beyond reproach.

"I want there to be no question that regardless of what action may or may not be taken in a given situation by enforcement officials, the General Electric Co. will continue to refuse any sanction to restrictive or collusive practices, or any other actions contrary to the antitrust laws. Even if this were not a matter of law and business ethics, sound business judgment would argue against actions that restrict competition.

"For a company that devotes as much of its resources to innovation and product improvement as General Electric does, nothing could be more self-defeating than to artifically impose a limitation on the business results of such leadership by engaging in price restrictions."

Meeting the competition

"What we can do now about foreign competition, it seems to me, depends largely on how well we do three things: First, through research and development, how well we develop new methods and better products; second, how well we continue to improve our productive efficiency; and third, how well we sell and service our products.

"But the basic problem will be solved to the best advantage of all concerned as we are able through greater productive efficiency to meet competition. For, we must compete! That is a job in which each of us, as individual

PARAFFIN PROBLEMS?

PARAFFIN SOLVENT

Dowell Paraffin Solvent is designed to free your wells of production-robbing paraffin. It will dissolve both pure and impure paraffin containing asphalt, sulphur, gum and salt. Effective for cleaning formation faces, tubing, rods, lead lines, tanks, screens, liners and perforations. **Non-chlorinated.** Easy to use. Easy to buy, too. Available at oil field supply stores and at Dowell stations.

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

ANOTHER HOMCO
DIRECTIONAL DRILLING
SUCCESS REPORT

Two Directional Drilling problems where Homco equipment saved hours of rig time

Gulf Coast independent operator says:

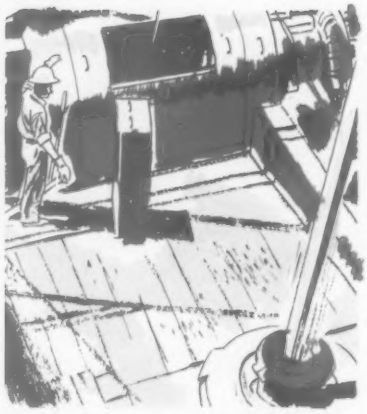
"Homco's Mechanical Orienting Tool saved me eight hours and fifteen minutes wire line time on two settings below 14,000 feet."

Terrebonne Parish, Louisiana

1. First whipstock was set at 14,363 feet with conventional BHO method and checked. Time required to orient tool was four and one-half hours. Second whipstock was set at 14,821 feet using a 6" O.D. Homco Mechanical Orienting Tool. Time required was thirty minutes. (Results were perfect.)

2. Third whipstock was set at 15,080 feet with the same Homco Mechanical Orienting Tool. Time required fifteen minutes. (Perfect results.)

3. The Homco Mechanical Orienting Tool saved more than four hours rig time each time it was used. It also eliminated the hazard of stuck pipe as the string can be actuated and circulation maintained. Abnormally high temperatures and extremely heavy muds have no effect on this tool.



Homco Mechanical Orienting Tool*

The HOMCO Mechanical Orienting Tool presents a new concept for orienting whipstocks and deflecting tools without the use of subsurface surveying instruments, which previously required two or more trips with a wire line to correctly orient the deflecting tool. The drill pipe is raised, rotated, and lowered until a ball falls into a slot which permits the tool to close and indicates that the deflecting tool is correctly oriented.

ADVANTAGES: Eliminates numerous trips into the hole with subsurface surveying instruments. Reduces orienting time to approximately twenty (20) minutes. Torque in drill string does not affect setting. Not affected by high temperature. Write for Technical Bulletin #51-1-1.

*Patent—U.S. Letters Patent No. 2,686,660

NEED THE ANSWER

TO A DIRECTIONAL DRILLING PROBLEM?
HOMCO HAS IT!

HOMCO

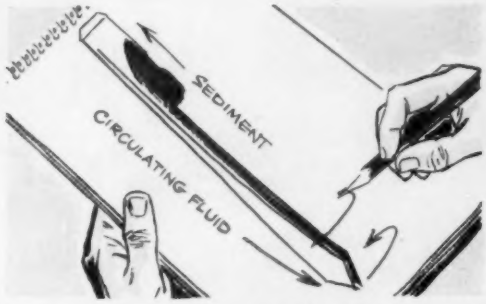
DIRECTIONAL DRILLING

California tool pusher says:

"Homco's Circulating and Releasing Whipstock is the only tool that circulates to the bottom of the hole and assures a firm setting for the whipstock."

"We've learned now that when we have to set a deflecting tool in the hardrock country, it saves time and money to have the Homco Circulating and Releasing Whipstock on hand. It has saved us rig time in West Texas, California, the Rockies, and Canada."

1. The HOMCO C&R Whipstock is installed on the drilling string and is lowered into the hole. There is no danger of shearing the pins. Should a bridge or fill be encountered, the whipstock is raised, circulation started, and the tool is rotated through the obstruction.



2. On reaching the bottom of the hole, circulation is commenced to wash any sediment or cuttings free which may impede the setting of the whipstock. Circulation and rotation are continued until the whipstock can be set firmly on the bottom of the hole. The whipstock can now be oriented in the correct direction by means of the HOMCO Mechanical Orienting Tool, or by other sub-surface orienting means.

3. After orientation, a ball is dropped into the drill pipe and pumped down to land in the ball seat on the upper end of the piston in the setting tool. The pumps apply pressure to the piston assembly until the pins between the upper shell and piston are sheared. The piston is forced downward permitting the shear balls to be forced from a position between the whipstock collar and lower shell into the setting tool. This diverts the circulation from the whipstock to the drill bit and disengages the setting tool from the clutch arrangement in the whipstock collar by lowering the drill string slightly. When disengagement is accomplished, rotation is commenced and a rathole is drilled in the conventional manner.

Homco Circulating and Releasing Whipstock*

In most directional drilling operations, a problem is the removal of sediment and cuttings that settle to the bottom of the hole after circulation ceases. This fill prevents the whipstock from reaching the bottom of the hole.

The HOMCO Circulating and Releasing Whipstock permits sediment to be circulated out of the hole before setting, eliminating mis-runs with whipstocks. The circulating fluid is channeled through the whipstock to the lowest point of the tool. While circulating, the HOMCO C&R Whipstock can be rotated without danger of shearing pins, assuring a firm seat.

ADVANTAGES: Eliminates danger of shearing pins while going into the hole. Whipstock can be rotated without danger of shearing pins. Circulation can be obtained at bottom of the tool where it is needed. Whipstock can be rotated and circulation maintained on bottom before setting, to assure a firm seat. Write for Technical Bulletin #94-7-1.

*Patent—U.S. Letters Patent No. 2,823,012

HOMCO

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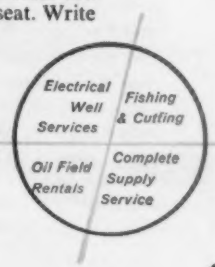

A PIPE LINE'S "HOLIDAYS" ARE FEW AND FAR BETWEEN WHEN

FIBERGLAS WRAPS IT UP

NEW FIBERGLAS® OUTER WRAP JOINS INNER WRAP IN CORROSION PROTECTION

Effective corrosion protection for underground pipe lines depends on the permanence, toughness and uniformity of pipe coatings. Enamel alone can't do a complete job. But when the right kind of reinforcement—Owens-Corning Fiberglas—is added to the enamel, the physical properties of the coating are improved and maximum protection made possible. There are fewer "holidays"—imperfections in the wrapping which lead to corrosion—and fewer breaks per mile. High-strength inorganic, non-cellular glass fibers reinforce the enamel so the coating stays in place to combat the corrosive forces continually at work underground.

Fiberglas Inner Wrap has compiled an outstanding record in reinforcing enamel. Now, as a companion product to its Inner Wrap, Owens-Corning Fiberglas introduces its new Outer Wrap. It's designed to act as an exterior protection for underground pipe lines from stresses of lowering and backfilling and from later soil movement. Superior Inner and Outer Wrap for underground pipe lines is another successful application of Fiberglas in industry. Find out about the advantages of Owens-Corning Anti-Corrosion products. Phone the Owens-Corning Fiberglas office nearest you. Or Owens-Corning Fiberglas Corp., Dept. 54C-29, Toledo 1, Ohio.

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businessmen, must assume a responsibility.

"And, part of that responsibility in the steel industry is to show our employes and their union leaders how a wage increase which exceeds the rise in productive efficiency, can, through its effect on competition, put rival workers in the steel mills of Europe and Asia in a better position to get their jobs.

"The union may feel, of course, that its problem is to protect the jobs of its membership by opposing any changes necessary for more efficiency. They may think that this is the union's problem and that competition is management's problem. But I believe that if union leaders will look carefully at both problems they will find that the two are really the same problem.

"The only way the steel industry—or any other American business—can protect the job of an American working man is if it is able to compete for business. And that means making steel—or making any American product—so efficiently that American production costs are held down to competitive levels."

Arthur V. Wiebel, president, Tennessee Coal and Iron division of United States Steel Corp., in a speech to the Purchasing Agents Association of Alabama.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

MARCH

6-9 American Society of Mechanical Engineers, gas turbine power and hydraulic conference, Rice Hotel, Houston.

7 Canadian Petroleum Association, annual general meeting, Hotel Palliser, Calgary.

7-8 University of Florida, annual heat transfer symposium, Engineering and Industries Building, Gainesville, Fla.

10 Petroleum Equipment Suppliers Association, northern Mid-Continent district meeting, Tulsa.

11 American Institute of Chemical Engineers, Sabine area section; American Chemical Society, Texas-Louisiana Gulf section, seventh annual joint technical meeting, Lamar State College of Technology, Beaumont, Tex.

12 American Institute of Chemical Engineers, Oklahoma state meeting, Bartlesville, Okla.

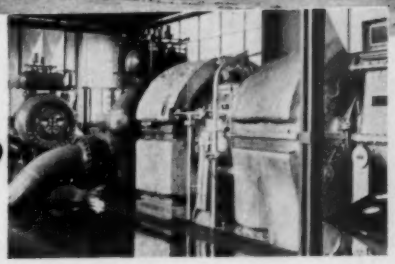
14-18 National Association of Corrosion Engineers, sixteenth annual meeting, Memorial Auditorium, Dallas.

16 Petroleum Equipment Suppliers Association, eastern district membership meeting, Duquesne Club, Pittsburgh.

16-18 American Petroleum Institute, Division of Production, southern district meeting, Hilton Hotel, San Antonio.

18 Natural Gasoline Association of

15,000 hp gas turbine, centrifugal compressor station uses HC® units by Young to cool lube oil.



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UNITS by Young... the practical way to AIR COOL GAS TURBINES

To cool the lubricating oil of gas turbines at compressor stations and other gas and oil installations, HC® Horizontal Core Units by Young are ideal. Single and multiple in-line units are available for handling cooling or condensing of unlimited capacities. Low maintenance costs, limited piping, elimination of water and water pumping systems, and water treatment are economic factors for selection of these units. Cross winds or blanketed core areas do not effect the cooling efficiency of these horizontal core units. A wide selection of cores serve all type of applications for cooling and condensing requirements.

At the 15,000 h.p. gas turbine station (above) heat from the lubricating oil is dissipated to the atmosphere with oil-to-air horizontal core HC® Units. This dissipated heat amounts to approximately one Btu per minute per horsepower. *No water is required in the cooling operation.*

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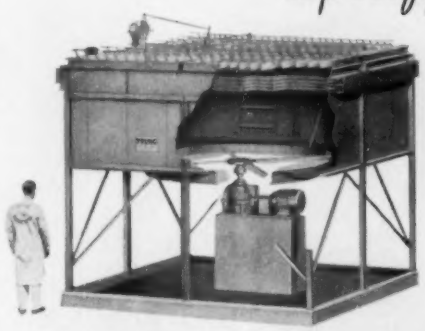

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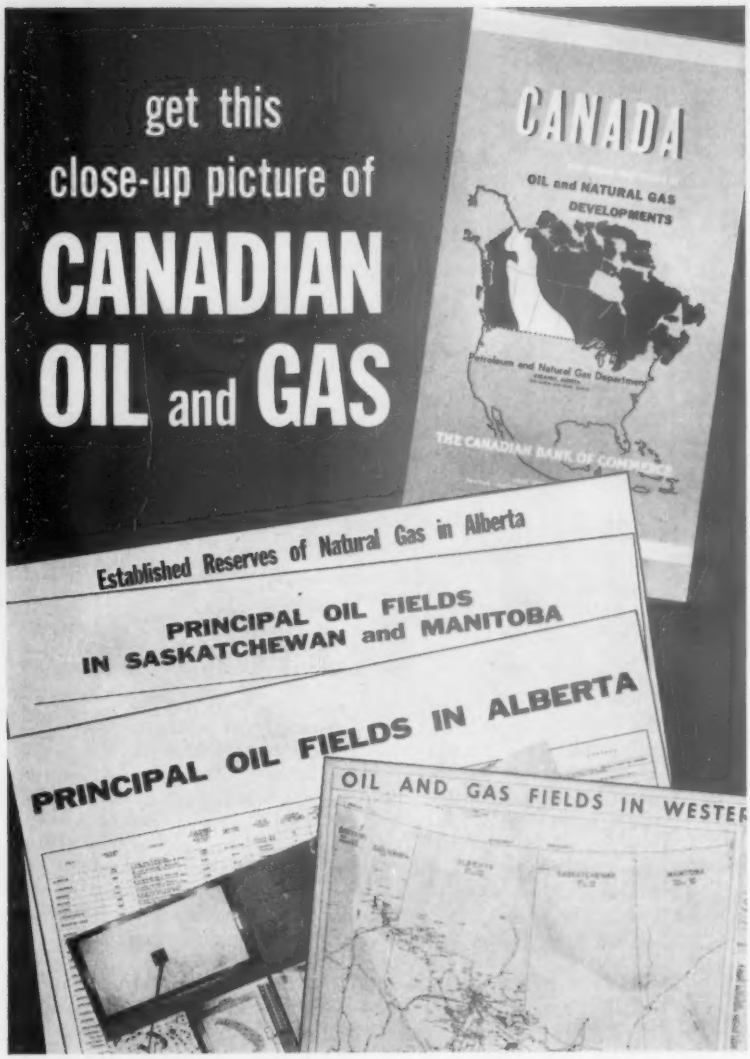

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America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

18 American Institute of Mining, Metallurgical, and Petroleum Engineers, upper Gulf Coast drilling and production conference, Beaumont, Tex.

21-23 Midwest Gas Association, annual meeting, Hotel St. Paul, St. Paul.

21 University of Texas, school of gas technology, sixth semi-annual term, Kilgore College, Kilgore. Term ends April 29.

23 Petroleum Equipment Suppliers Association, Pacific district annual membership meeting, Ambassador Hotel, Los Angeles.

24-25 New England Gas Association, annual meeting, Hotel Statler-Hilton, Boston.

24-25 American Institute of Mining, Metallurgical, and Petroleum Engineers, petroleum conference on reservoir and production engineering, Tulsa.

25-26 North Texas Oil and Gas Association, thirtieth annual meeting, Kemp Hotel, Wichita Falls, Tex.

28 University of Texas, American Petroleum Institute Division of Transportation, school of pipeline technology, eighth semi-annual term, Lee College, Baytown, Tex. Term ends May 6.

28 University of Texas, American Petroleum Institute Division of Production, institute on automatic production controls, first term, Odessa College, Odessa, Tex. Term ends May 6.

29 Petroleum Equipment Suppliers Association, Gulf Coast district membership meeting, Shamrock Hilton Hotel, Houston.

28-30 Western Petroleum Refiners Association forty-eighth annual meeting, Hilton Hotel, San Antonio, Tex.

29-31 American Power Conference, annual meeting, Sherman Hotel, Chicago.

30-Apr. 1 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita.

APRIL

3-8 Engineers Joint Council, sixth nuclear congress, New York.

4-7 Oil Heat Institute of America, annual convention, Park-Sheraton Hotel, New York.

4-7 National oil heat and air-conditioning exposition, Coliseum, New York.

5 Petroleum Equipment Suppliers Association, southern mid-continent district membership meeting, Statler Hilton Hotel, Dallas.

5-6 University of Kansas, eighth annual gas compressor institute, National Guard Armory, Liberal, Kans.

5-7 Instrument Society of America, national chemical and petroleum instrumentation symposium, Rochester, N. Y.

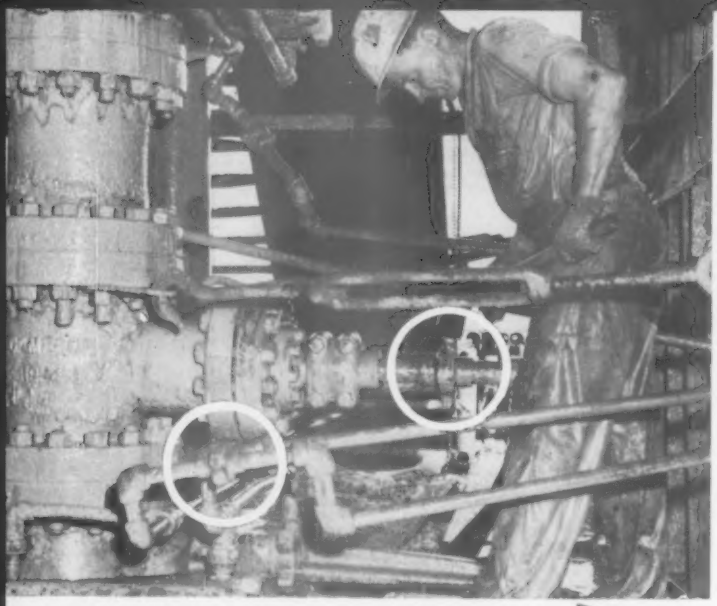
7-8 Rocky Mountain Oil and Gas Association, midyear meeting, Newhouse Hotel, Salt Lake City.

8 Chemical Institute of Canada, rubber chemistry division, annual meeting, Kitchener, Ont.

12-14 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, conference and exhibition, Municipal Auditorium, Kansas City.

14-16 Society of Economic Paleontologists and Mineralogists, Permian Basin section, annual meeting, technical session and field trip, Windsor Hotel, Abilene, Tex.

15-16 Society of Economic Paleontologists



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WECO UNION

The strong Acme threads on nuts of WECO Unions hold against vibration, surge and s precision machined pipe thr proper taper, length and strength and leak-proof make

With WECO Unions on you preventer hook-ups . . . mud li pipe . . . water, air, fuel and st your rig piping is secure aga for the duration of the job.

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The perfect interchangeability Unions means that subs and n same size and pressure rating w and mate perfectly so there's lost searching and sorting fittings with the right unions up lines and hook up equipme

And there's no problem with cause the WECO Union ball seat seals perfectly on well a regardless of the number of and break-outs.

SECURE
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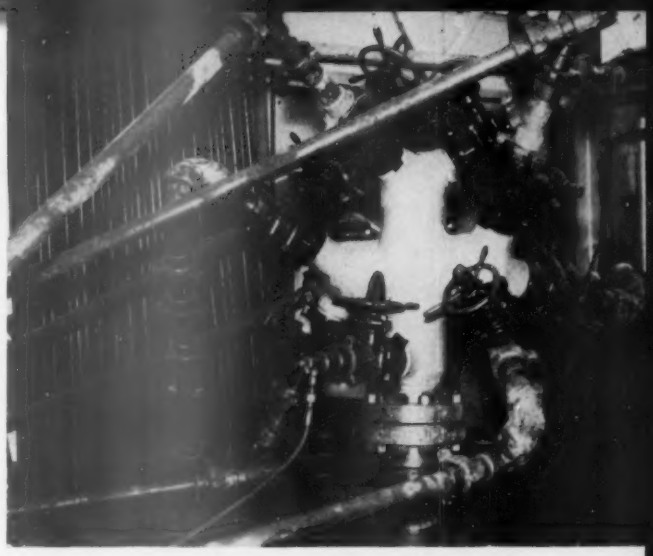

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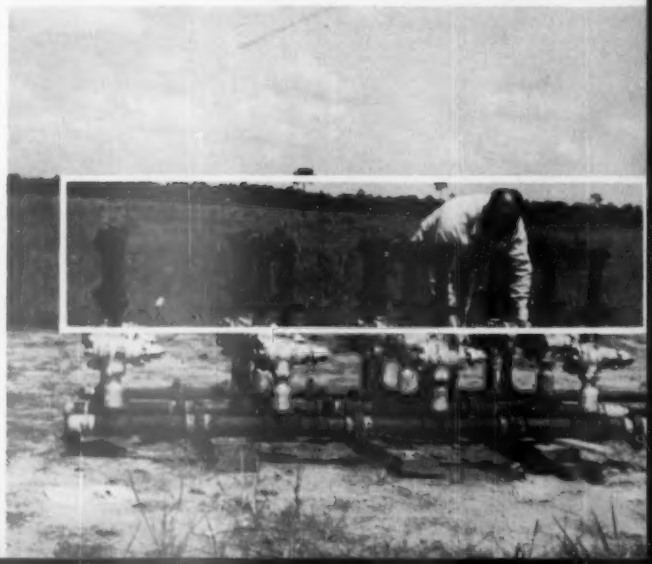
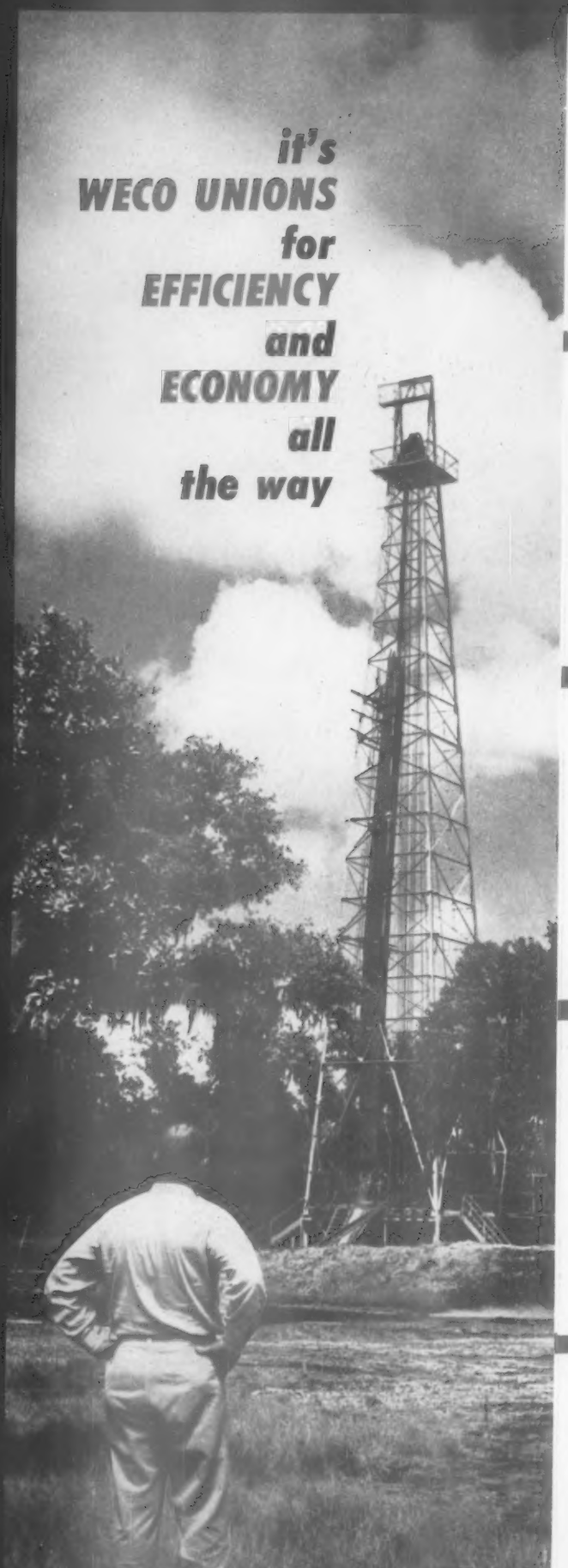
Service company operations . . . cementing, acidizing and fracturing . . . require the maximum in leak-proof connections, the highest frequency of make-up and break-out in line and manifold connections; equipment with the strength and toughness to hold abrasive laden fluids at high pressures. WECO Unions simplify make-up and breakout on job after job without leaks, without cutting out. That's why more WECO Unions are used by more service companies than all other unions combined.

WECO UNIONS SIMPLIFY PIPING LAYOUT ON PRODUCTION HOOK-UPS

Separators and tank batteries; heater, treater installations; field headers and manifolds; metering station manifolds; flow lines and well head connections are made up quicker and more efficiently with WECO Unions. The ball and cone seat provides a perfect seal; the Acme threads on sub and nut make up fast and easy; precision machined pipe threads fit and seal perfectly.





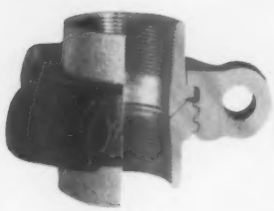


Fig. 100 Union
Sizes: 2, 2½, 3, 4, 6, 8
1000 psi Test

Sizes

Fig. 400 Union
Sizes: 6, 7, 8, 10*, 12*
4000 psi Test
*2500 psi Test

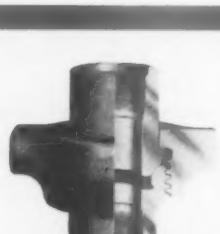
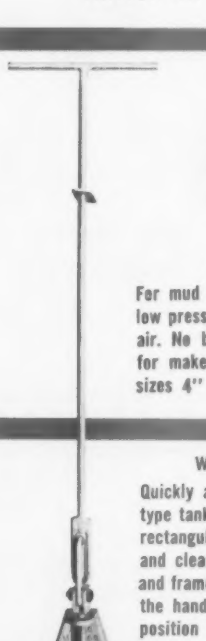


Fig. 1502 Union
Sizes: 2, 2½, 3
15,000 psi Test



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Quickly and easily install type tank or vat, it provid rectangular opening for and cleaning. Rubber seal and frame prevent leakage the handle forces gate in position in frame.

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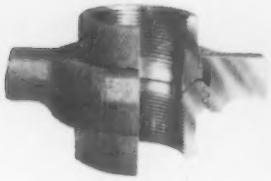


Fig. 200 Union
Sizes: 1, 1¼, 1½, 2, 2½, 3, 4, 6, 8, 10
2000 psi Test

Fig. 208 Union
Sizes: 3, 4, 6, 8, 10
2000 psi Test

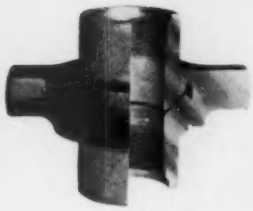


Fig. 400 Union
Sizes: 2, 2½, 3, 4, 5½
4000 psi Test

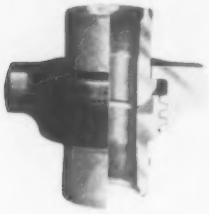


Fig. 600 Union
Sizes: 1, 1½, 2, 2½, 3, 4
6000 psi Test

Fig. 602 Union
Sizes: 1, 1¼, 1½, 2, 2½, 3, 4
6000 psi Test

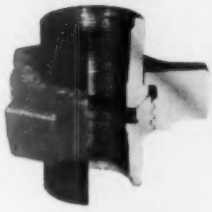


Fig. 1002 Union
Sizes: 1, 1½, 2, 3, 4
10,000 psi Test

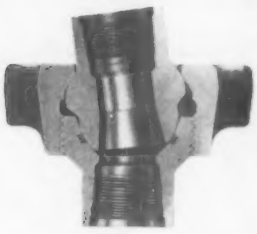
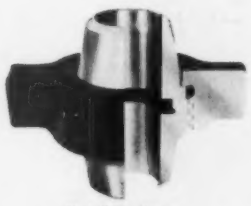


Fig. 1003 Mis-Aligning Union
Sizes: 2, 2½, 3, 4
10,000 psi Test

Fig. 211 Insulated Union
Sizes: 1, 1½, 2, 2½, 3, 4
2000 psi Test



Flat Face Union
Sizes: 2, 3, 4
Fig. 415, 4000 psi Test
Fig. 615, 6000 psi Test

-O-UNION

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WECO "33" COATED UNION

This special coating makes any size or pressure WECO Union fully insulated. Also provides more protection against corrosion. "33" coating is applied internally and externally for complete protection.

WECO TUBING WET BOX

Light and easy to handle, it clamps around the tubing joint and prevents fluid from spraying over the work area. One box fits all tubing sizes by changing the rubber seal in top of the box.

NOUT GATE

installed on any provides a large g for emptying er seals on gate eakage. A cam on gate into sealing

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HOUSTON, TEXAS

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U-2-60

and Mineralogists, Pacific section, annual spring field trip, Panoche Hills, San Joaquin Valley, California, and evening meeting, The Hacienda, Fresno, Calif.

19-21 University of Oklahoma, College of Engineering, southwestern gas measurement short course, north campus, University of Oklahoma, Norman.

19-21 American Society of Lubrication Engineers, annual meeting and lubrication exhibit, Netherland Hilton Hotel, Cincinnati.

20 Chemical Institute of Canada, joint meeting, Quebec rubber and plastics group and Montreal section, Queen's Hotel, Montreal.

20-22 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

20-22 National Petroleum Association, semiannual meeting, Hotel Cleveland, Cleveland.

21-22 Oklahoma State University, technical conference on heat transfer, Stillwater, Okla.

21-22 Texas Technological College, seventh annual West Texas oil lifting short course, Lubbock, Tex.

24-26 Independent Petroleum Association of America, midyear meeting, Denver Hilton Hotel, Denver.

25-26 American Society of Mechanical Engineers, maintenance and plant engineering conference, Chase-Park Plaza Hotel, St. Louis.

25-27 Southern Gas Association, convention, Buccaneer and Galvez hotels, Galveston.

25-28 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

25-29 American Welding Society, annual meeting and welding exposition, Los Angeles.

27-29 Natural Gasoline Association of America, annual convention, Rice Hotel, Houston.

28-29 American Petroleum Institute, Division of Transportation, pipeline conference, Mayo Hotel, Tulsa.

28-29 Pacific Coast Gas Association, distribution conference, Benson Hotel, Portland.

MAY

1-3 Texas Independent Producers and Royalty Owners Association, fourteenth annual membership meeting, Holiday Inn, Carlton and Blackstone Hotels, Tyler, Tex.

1-4 American Petroleum Institute, Division of Transportation, tanker conference, Seaview Country Club, Absecon, N. J.

2-3 Society of Petroleum Engineers of AIME, North Texas section, fourth biennial secondary recovery symposium, Wichita Falls, Tex.

5-6 American Institute of Mining, Metallurgical and Petroleum Engineers, annual joint meeting of Rocky Mountain petroleum sections, Calgary.

5-6 Canadian Institute of Mining and Metallurgy, annual technical meeting of petroleum and natural gas division, Palliser Hotel, Calgary.

9-12 American Petroleum Institute, Division of Refining, midyear meeting, Statler and Sheraton-Cadillac hotels, Detroit.

9-12 Instrument Society of America, instrument-automation conference and exhibit, Civic Auditorium and Brooks Hall, San Francisco.

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R.S.Anderson Oil Company uses Republic SRK Plastic Pipe in flow lines and salt water disposal systems

With more than 15,000 feet of Republic SRK® in service, the R. S. Anderson Oil Company, Midland, Texas, is no stranger to plastic pipe.

Anderson has been using SRK Plastic Pipe to handle sour crude for more than three years. In lines previously replaced every six to eight months, SRK is still in service. Anderson reports no corrosion, no evidence of chemical action in general, and very little damage from abrasion. Savings—already estimated at 50%—grow with every added day of service.

The key to these savings, according to Anderson, is *good* plastic pipe. In the manufacture of SRK, Republic starts with the finest raw materials, follows through with the best equipment and techniques, finishes only after *every length* of pipe has been thoroughly inspected.

SRK is available in a wide range of pressure ratings and sizes from ½″ through 8″. For further information, get in touch with your nearest Republic distributor. Or, clip and mail the coupon at right.

The pipe seen is 2″ Republic SRK (semi-rigid type) rated at 150-lb. It is being installed in the Anderson Company's Westbrook field by the San Andress Construction Company, Snyder, Texas.

REPUBLIC COLD FINISHED ALLOY BARS are used by the S. M. Jones Company, Division of Buffalo Eclipse Corp., Toledo, Ohio, in the production of Sucker Rod Couplings which must withstand static and dynamic loads of up to 40,000 psi. Republic Alloy Steels provide an outstanding combination of qualities which permit the use of smaller, lighter cross sections. Send for data.

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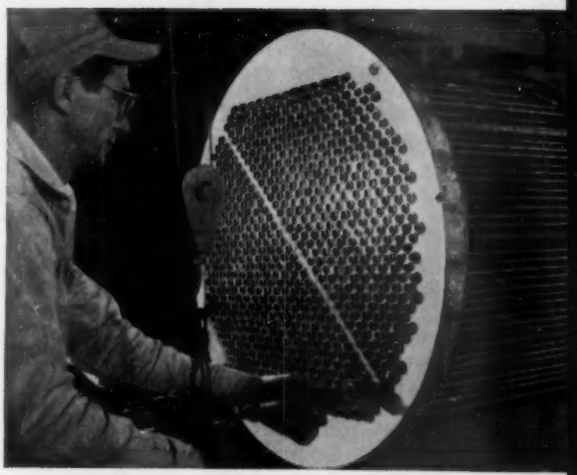

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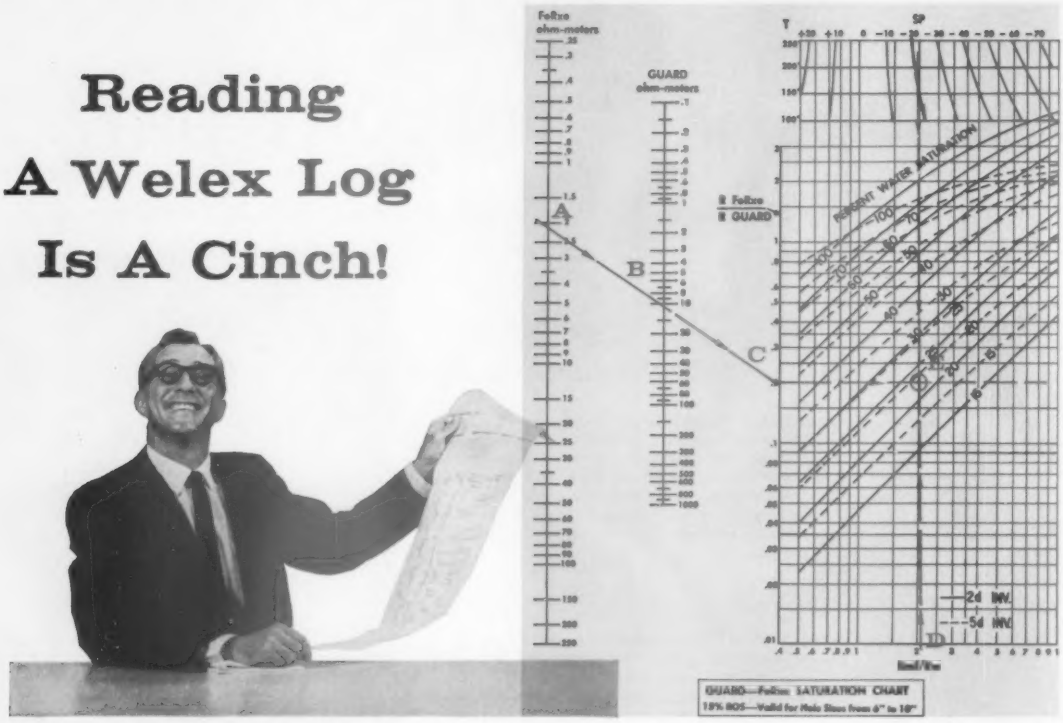

That's right — it's as easy as drawing a straight line.

With Welex's new simplified interpretation charts, or "pigtails," printed right on the log where they are always convenient, you can read POROSITY directly off the log and calculate FLUID SATURATION in seconds. No complicated computations are needed.

To use the Guard-FoRxo "pigtail" above to figure FLUID SATURATION, follow these simple steps. In this example, values read directly off the log in the zone of interest were: FoRxo 2 Ohms; Guard 10 Ohms; SP (self potential) —22 millivolts.

A. Pinpoint the FoRxo value on the FoRxo scale.

B. Pinpoint the Guard value on the Guard scale.

C. Connect points "A" and "B" with a straight line and extend it to intersect the side of the water saturation chart at point "C". Draw a horizontal line from point "C" across the chart.

D. Pinpoint the Rmf/Rw value (if known from Rw data in the area) on the Rmf/Rw scale at the bottom of the chart and raise a vertical line to intersect the horizontal line at point "E". (If Rw data is not available, an alternate method is to pinpoint the SP value (—22 millivolts) on the SP scale at the top and drop a vertical line.)

E. Read the percent of FLUID SATURATION at the intersection of the two lines.

The answer in this illustration is 22 percent.

And just as simple as the "pigtail" is the actual selection of the right logging service for your well, thanks to Welex's new simplified logging program. Based on type of porosity and the salinity contrast between drilling mud and formation water, the diagram here shows how simple it is to choose the right logs without running any excess logs.

For example, the diagram shows that if the salinity contrast is low and the porosity is intergranular, the best log for your well is Welex's Guard-FoRxo. If the porosity is the same type and the salinity contrast is high, the best choice is the Induction FoRxo.

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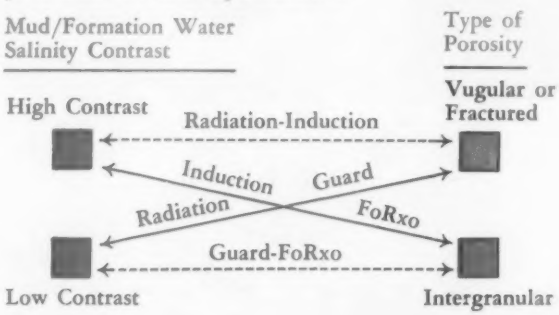
For the right logging answer for your well, call your nearest Welex representative.



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the Journal said...

50 years ago

March 6, 1910

Assured that northwestern Louisiana gas fields will be drawn on to supply a projected pipeline to St. Louis, operators in the district hold emergency session with state conservation officials to plan action to stop gas waste in the fields.

Natural gas delivered by Lone Star Gas Co. through its new 100-mile 16-in. pipeline from fields in Clay County, Texas, is turned into Consumers Light & Heating Co.'s distribution lines formerly serving Fort Worth with artificial gas. Lone Star is pushing work on its extension line to Dallas, due to get natural gas before May 1.

25 years ago

March 7, 1935

Stanolind Oil & Gas Co. (Pan American) acquires properties of Yount Lee Oil Co., one of the Gulf Coast's oldest and largest independent producing companies, in $50,000,000 deal. Purchase marks Stanolind's debut as producing company on Gulf Coast, and sets it up initially as fourth largest.

Long-planned oil exchange opens at Commodity Exchange, Inc., in New York, with trading in crude-oil and gasoline futures at prices slightly higher than current market.

Gulf Production Co.'s 103 McElroy, in McElroy field, Upton County, West Texas, becomes deepest test in United States. Drilling passes 11,380-ft. depth record set 2 years ago by General Petroleum Co.'s 1 Berry, in South Belridge field, California.

10 years ago

March 9, 1950

Kentucky-based Ashland Oil & Refining Co. purchases Frontier Oil & Refining Corp. of Buffalo, in fourth acquisition within the past year. The addition boosts Ashland's refining properties in four states to total crude-charging capacity of 77,000 bbl. daily.

Royal Dutch Shell group and Standard Oil Co. (Ecuador) halt exploration in Ecuador after 12 years of thorough geological and geophysical investigation, drilling of six tests, and expenditure of $40,000,000 without finding any oil or gas.

California inventor Miles J. Lewis tests new combination rotary and percussion drill designed to expedite hard-formation drilling. The Bassinger-Shell rotary-percussion drill, now being developed, will be tried out soon in a well for Magnolia Petroleum Co. in Pegasus field, Upton County, West Texas.

JOURNALLY SPEAKING

Lousy Monopoly

This "oil monopoly" some people keep talking about is the darndest monopoly we ever saw. Like crazy, man.

Over the years a good many college profs have sat in their ivory towers and written books about how the oil industry is a monopoly (or a duopoly or an oligopoly or a cartel or a conspiracy or a combination of some description)—meaning that by some devious means it manages to keep supplies low and prices high, competition down and profits up.

Brother, they ought to see it now.

The guys who are supposed to be running this monopoly are sure doing a lousy job.

They've managed to keep supplies so scarce that the world surplus of crude will continue for only another 10 or 20 years—provided no more oil is discovered in the meantime. But their controls must have slipped somewhere, because they don't seem to be able to prevent people from bringing in new oil wells in just about every country on the globe.

Here in the United States they've squeezed things down so that we can produce only about 3,000,000 bbl. per day more than we need.

Well, the professorial and senatorial critics may say, maybe this oil monopoly can no longer control the amount of crude oil in the world, but it can keep supplies scarce by regulating refining and distribution.

But the record in that area isn't so hot either. If there's anything that everybody in the industry complains about week after week and year after year it's that too much oil is being refined. But apparently this message isn't getting through to the monopoly's bosses very clearly.

There's so much gasoline and fuel oil on the market that the refiners and distributors are trying to get rid of it by giving away dishes, green stamps, and all sorts of prizes—and even practically giving away the oil. That's a strange definition of scarcity in anybody's economics book.

Of course the purpose of making supplies scarce by artificial means—what the classical economists call withholding—is to create a sellers' market so prices will be high.

Just look at oil prices today. Some of them are lower than they've been for years, and they are still on the skids. They vary from place to place and almost from hour to hour. The market is so sloppy that a price quotation hardly means a thing because a lower bid will usually get a deal. The only withholding seems to be on the part of the customers who withhold their buying until they get a lower price. If that's not a buyers' market we never saw one.

A phrase that the industry's critics have mouthed so often that they mumble it in their sleep is "There's no competition in the oil business."

Hah! Drive down any street. Notice how many filling stations are fighting each other for customers. This morning on our way to work we passed a corner where two stations were closed and for rent and the remaining two were having a price war.

No competition among filling stations? Ask the man who owns one.

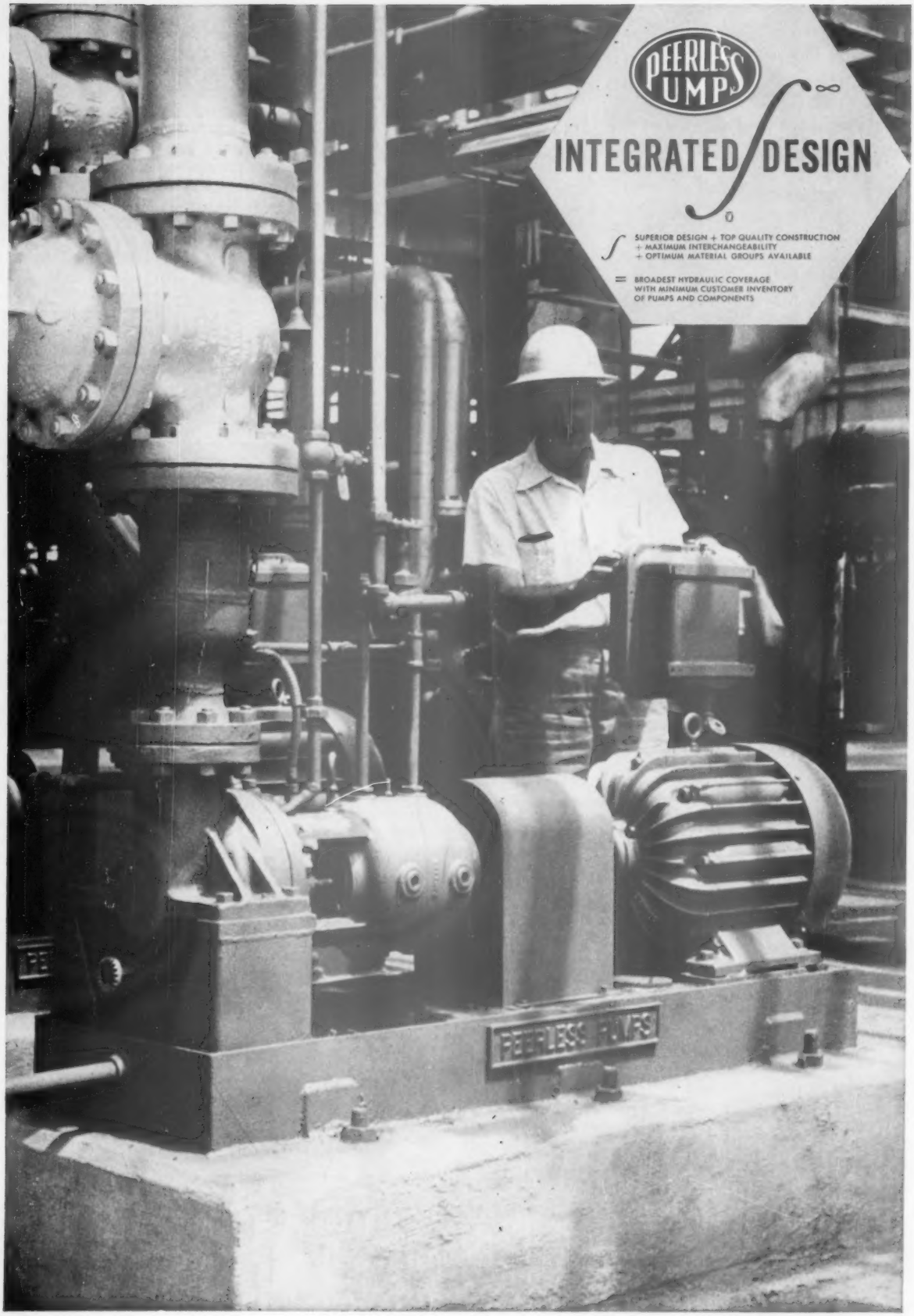
And as for keeping profits up, have you noticed how Wall Street evaluates oil stocks these days?

For years oil men have been saying that they ought to have better public relations so that people would understand the industry. We are inclined to agree with the recent crack by an oil man that it's a good thing the industry isn't better understood, because if the public really knew how poorly the oil business is run it would be a national scandal.

We suggest that some economics professor take a new approach and write a book about how badly the oil industry manages its affairs and how far it has missed the objectives that monopolies are supposed to achieve.

He would have to conclude that the men running this oil monopoly ought to be ousted for incompetence. Would it be too much to expect him to conclude that they had been ousted long ago—or that there never were any such in the first place?

—Henry D. Ralph.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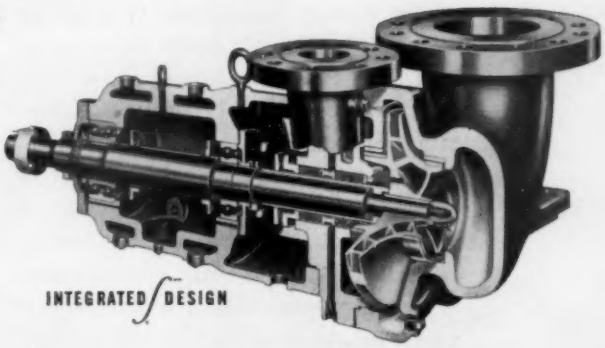

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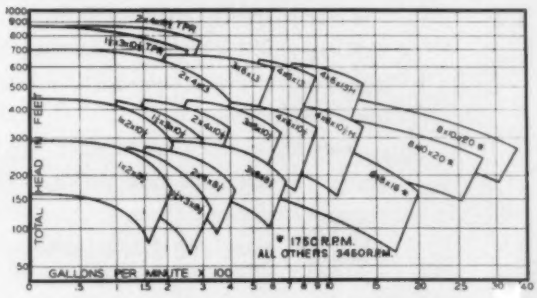

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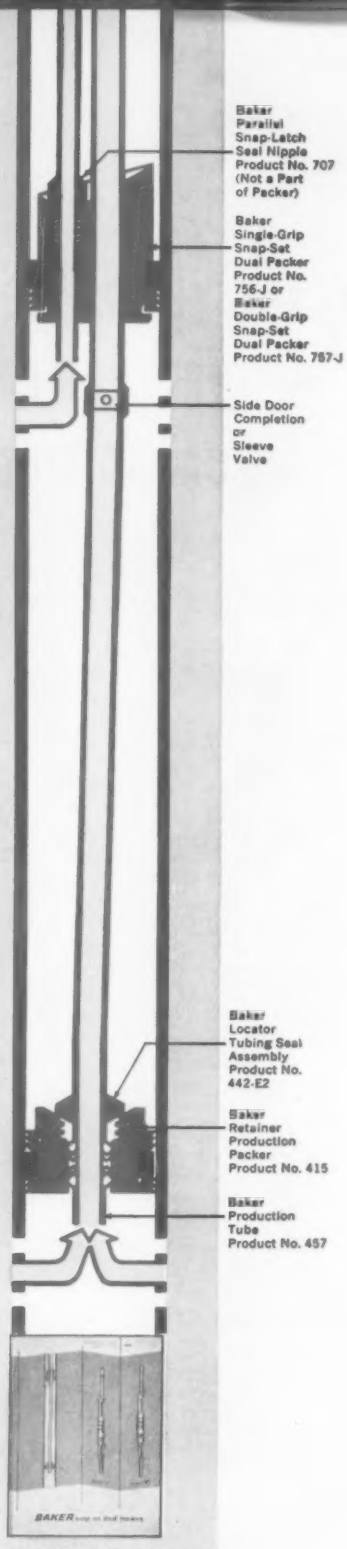
Shown is the Model "J", Single-Grip, Product No. 756-J.


Baker Parallel Snap-Latch Seal Nipple Product No. 707 (Not a Part of Packer)
Baker Single-Grip Snap-Set Dual Packer Product No. 756-J or Baker Double-Grip Snap-Set Dual Packer Product No. 787-J
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CATALOG SUPPLEMENT NO. 357 describes Baker Snap-Set Dual Packers in complete detail.

BAKER OIL TOOLS, INC. HOUSTON LOS ANGELES NEW YORK

Enough of this brinksmanship

THE CURRENT ACTION of a number of big refiners in cutting back their runs can hardly be called an act of industrial statesmanship.

Coming at the tail end of a season of poor demand, during which excesses were piled on excesses of refined-products inventories and prices kept crumbling, curtailment of output could better be described as "brinksmanship" than statesmanship.

Oil executives must like to live dangerously. They seem to enjoy leading themselves—and the whole industry—as close as possible to the brink of disaster. Maybe they experience a daredevil sort of heroism in scrambling back toward safety at the last minute.

WE'VE HAD ENOUGH of this brink stuff. The industry has been in a continuous state of crisis for 2 or 3 years, an oversupply crisis of its own making.

Investors, among others, are entirely fed up with it. Talk to any broker, or read any market letter, and you'll learn that the reason oil stocks are down and oil companies have trouble getting finances is that investors have lost confidence in the ability of the industry to manage its affairs so as to provide adequate earnings.

That needn't be so. No industry in the country has more accurate forecasts of demand or better current statistics on output and inventories. And none other has legal and effective devices like state-enforced allowables and purchaser-imposed proration to keep the supply of raw material in balance with demand.

So the constant oversupply must be chalked up to bad management. And this means chiefly the heads of the 30 or so major companies that nominate for and process some 85% of all the oil. Why they can't interpret statistics and separately use enough self-restraint to keep from glutting their own markets is a mystery to many people in and out of the industry.

IT'S NOT STATESMANSHIP to drive pell-mell for volume regardless of conditions. It's not good management to depend solely on maximum throughput to yield a profit. It's not even horse sense to continually make more than can be sold.

Perhaps the March curtailments in crude production and refinery runs will not be too little and too late to snatch the industry back from the brink of financial collapse. But then will we head for another brink in a couple of months?

It's high time everybody in the oil business learned a couple of elementary facts: The industry has capacity to supply a lot more oil than consumers can use; profits come from barrels times price, not from barrels alone.

It shouldn't take high statesmanship to figure that out.

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FPC Tries New Approach in Gas Cases

• The pre-trial conference technique which speeded up the Tulsa "conspiracy" case may be adopted for FPC hearings. There are some serious doubts the method will work, but a TGT case is set up to test this new approach.

WITH AN ENERGY that stems somewhat from desperation, the Federal Power Commission is trying a new approach in an effort to speed the disposition of natural-gas cases.

Basically, what it is trying to do is this: Break a case down into its basic parts and seek to dispose of each segment as promptly as possible.

Hand-in-hand with this procedure will be an effort to eliminate some of the cumbersome detail which in the past has helped drag cases out in seemingly endless fashion.

The basic tool to be used will be a prehearing conference. At one of these, the examiner, the companies involved, and the intervenors will try to reach agreements on core issues to be decided so the case can be handled with more dispatch and with less legalistic mumbo-jumbo.

Furthermore, the hearing examiners are being given wider authority to rule on procedures to avoid delays.

In effect, what is being tried is very similar to pretrial conferences many judges now use. (A striking example was the use made of this device by U. S. District Judge Royce H. Savage in preparation for the recent Tulsa "conspiracy" case. Observers felt this cut weeks off the trial time.)

At this stage of the FPC test there are optimists, pessimists, and skeptics.

Even the optimists, however, don't expect magic results. But they do feel that considerable time may be trimmed in individual cases and that this will make possible the handling of more and more cases.

For example, one examiner has mapped out a 9-month schedule for a case which normally would be spread over a period of 2 years or more.

Admittedly, in this case, the examiner, the FPC staff, and the companies involved will be making a special effort to speed the mechanics. Not every case could be handled in such a fashion. Even so, if the new approach saves a few months, or even a few weeks, the time so saved could be used on other cases.

Furthermore, should the test cases reveal useful shortcuts, the time savings could gradually add momentum to the FPC disposition of its monstrous backlog.

Pessimists and skeptics . . . Some experienced pipeline company officials say the new approach may lengthen, rather than shorten, the life of a case.

They fear that if a case is broken into three or more parts, it could wind up as three or more cases, with three times as many chances for appeals, court tests, etc.

At the very least, the pipeline officials foresee the likelihood of preconference hearings being used largely for all factions involved to argue their points. If so, this would simply mean more consumption of time.

They also have serious doubts that one phase of a case can be settled independently of the other phases. They ask: How, for instance, can a rate of return be decided fairly before other factors which may affect a rate of return are settled?

The skeptics, and these include many attorneys, fear that any substantial short-circuiting of normal legal procedures is "likely to lead to more appeals, reversals, and delays than you could shake a stick at."

But no one denies the crying need for some approach which would enable the FPC to make some headway.

Clouded prices . . . As it stands now, in many situations no one knows for years on end what he is going to pay for the gas he buys, or get for the gas he sells.

Often a new rate hike is sought long before final action has been taken on an earlier rate hike. And there are times when still a third rate increase is requested before the first one is settled.

This is tough on all concerned.

The producer, not knowing what he is going to receive eventually, can hardly use sound judgment in deciding whether to step up, or slow down, exploration and drilling activities.

The interstate pipeline, with a great deal of its money tied up subject to refund, in case a higher rate it has been collecting is eventually struck down, faces a weakened financing position because lending agencies are concerned with final rates, not those still waiting approval.

And the distributing company, facing its own regulatory commissions, is under a big handicap because it is in the position of trying to get its rate base established or adjusted when it doesn't even know what it will have to pay for the gas.

A new attempt . . . The effort of one examiner—Joseph Zwerdling—serves as a good illustration of at least one possible approach.

Zwerdling, who wrote the examiner's decision in the key Phillips case, is now involved with a complex case in which Tennessee Gas Transmission Co. is seeking a rate hike.

Tennessee's case is one of those involving "locked in" rate hikes. That is, Tennessee has three successive rate cases pending even though the first one has not been settled.

Tennessee first filed for a rate increase in January 1957. Hearings were started in April of that year but haven't been completed yet. In November 1958, the firm filed for a higher rate and, after the normal 6-month suspension, began collecting that rate, too, although both rate hikes are still subject to refund.

Finally, last October, Tennessee filed the third rate hike. These three rate increases total more than $70 million annually. But the company doesn't know how much of that it will eventually get to keep. And the companies buying from Tennessee obviously don't know yet what they may eventually have to pay.

This, then, is the case that the hear-

ing examiner, Zwerdling, hopes to clear up in the next 9 months.

And here is the way he is attempting to do it:

In February, Zwerdling held a series of prehearing conferences. At these conferences, he sought out the "gut" issues of the case.

As these key issues were shaped up, he asked the FPC staff, attorneys for the pipeline company, and the intervenors how much time each would need to prepare for a hearing on a specific issue.

As it turned out, it appeared that the question of the rate of return for Tennesseee could be settled in the shortest time, largely because the FPC staff conceded that it could present its views on this issue without conducting a full-fledged field study.

So Zwerdling set a hearing for April 4 on the rate of return alone. Other issues will not be determined, nor discussed, at that session.

And Zwerdling also took another step to speed the proceeding: He is requiring the FPC staff and intervenors to present their proposed evidence on the issue of rate of return by March 15. By this means, both parties will be ready for cross-examination at the April hearing.

Some differences . . . Normally, in the initial step of a hearing, the company presents its evidence and the staff and intervenors then ask for a long recess in which to prepare their cross-examination.

After the second step, the cross-examination of company witnesses, another recess usually follows to give the staff time to prepare its own case. After the third step, there is still another recess to enable the company to get ready to cross-examine the staff and witnesses for the intervenors.

What Zwerdling is trying to do is compress these four steps into one, thus eliminating three recess periods, each of which would normally last for 2 months or more.

After the April hearings, Zwerdling will decide whether to issue an interim order, disposing of the rate of return part of the case.

Some of the critics, or skeptics, of the new procedure are unhappy about this trend to an interim decision on only one part of a case. They fear such a piecemeal approach will simply mean a greater and greater delay before the entire case is settled.

But Zwerdling doesn't think this is necessarily so. In the first place, he considers the interim decision approach as only one possibility in the speedup procedure. He concedes there may be instances in which it should not be used, and cases in which some other time-saver would be better.

Moreover, in the Tennessee case, Zwerdling is not letting the other issues lie idle while the rate of return is being settled.

He has set a second hearing for May 23 at which the issues of the purchased costs of gas and Tennessee's depreciation rate will be tried.

Here again, he has called for advance written testimony so that each party will be able to cross-examine during that hearing without delay.

At the end of that session Zwerdling again will decide whether to issue an interim decision or let the matter ride until the other issues have been settled.

Finally, he is planning a hearing for September on the issue of the "rate tilt" and on a package of other, less important issues. Once again, the principals will be expected to come to the hearing ready for cross-examination.

Zwerdling thinks the hearings can be completely finished on all issues by the middle of October—and the first prehearing conference was held in February. That would be 8½ months, an unusually short time for a major case.

Other possibilities . . . Meanwhile, two other hearing examiners are working out shortened proceedings for rate cases involving Panhandle Eastern and Northern Natural Gas Co.

Zwerdling is hopeful that the industry will not give up on the possibilities of a speeded-up process, even if one or all three of the current tests run into trouble.

His view is that since they are trying to carve out new paths, they are likely to run into difficulty and delays. Successive efforts, he feels, will move with more dispatch because all parties involved will be better acquainted with the procedures and the results.

"We will learn as we go along," Zwerdling says.

The effort to chart a course through the maze of regulatory procedure is not new. The FPC Bar Association set up a committee in 1958 made up of representatives of various groups, with FPC staff members and advisers.

The proposals drafted by the committee were submitted to the commission in June 1959. The main target of these proposals was to make really effective use of the conference procedure to eliminate delays.

The FPC adopted the bar report last November and issued Order 217 authorizing the conference approach.

Observers feel that the outcome may well depend on the quality of FPC hearing examiners, since the new procedure gives them a great deal of authority in ruling on procedural questions.

The months ahead should give some indication of the outcome of the acceleration attempts.

It Now Costs More to Refund Rate Hikes

THE FEDERAL Power Commission has hiked the interest a producer or a pipeline company must pay if it has to refund all or part of a rate increase.

The new interest rate, effective immediately on price hikes put into effect after March 1, will be 7%, instead of 6%.

Under FPC rules, a company can put a new rate hike into effect after a 5-month wait following a filing of a new rate schedule with the commission. However, the increased payments are subject to refund, with interest, to the customers if the FPC eventually refuses to allow all or any of the increase.

The commission explained its action by saying that in view of the cost of money available for borrowing by natural-gas companies, the interest rate of refunds should be adjusted to put it more in line with commercial rate practices.

Higher return . . . The FPC's action seemingly would add weight to the requests of many companies for a higher rate of return on their own investments, for the companies making such requests have frequently pointed out rising money costs as an increasingly important factor.

The commission has shown signs of increasing rates of return, granting a 6½% rate of return to the Manufacturers Light & Heat Co.

Manufacturers had asked for a 6¾% rate of return, while the FPC staff recommended a 6¼% rate.

In setting the 6½% rate, the commission pointed to the sharp rise in the cost of debt throughout 1959, and said that the 6¼% rate proposed by the FPC staff would not continue to produce a return on equity approaching 10%, while a 6½% rate would.

THE SEARCH by American Cyanamid for an auto afterburner to cut down air pollution . . .

LED TO DEVELOPMENT of a hydrocarbon analyzer. The model at the left is a lab model; the one at the right a portable model.

New Hydrocarbon Analyzer Has Many Uses

• American Cyanamid developed analyzer to check out air pollution, but it can be adapted to other oil operations.

AMERICAN Cyanamid Co. research engineers, working on development of an automobile afterburner, have come up with a valuable byproduct—a device that will measure the hydrocarbon content of gases.

And not only did the engineers design a fast and economic hydrocarbon analyzer, but they're convinced success is near in development of a catalytic muffler to reduce hydrocarbon pollution of the atmosphere.

In addition to measuring the hydrocarbon content of gases, the analyzer is adaptable to a host of other uses in the oil industry.

It is called FICA, short for flame ionization continuous analyzer. It measures the amount of hydrocarbons in the atmosphere or exhaust gas. It is used in conjunction with other devices to determine their type and quantity.

FICA makes use of the electrical conductivity of large concentrations of charged particles that are present in a hydrocarbon flame. The amount of electricity conducted by the ionized particles, when voltage is applied indicates the amount of hydrocarbons in the gas being analyzed.

When used with a gas phase chromatographic column, FICA can separate and measure individually the various types of hydrocarbons. It is highly sensitive and can detect hydrocarbon concentrations as low as ten parts per billion.

The analyzer is very compact. It measures about 7 in. in length, 6 in. in height, and 5 in. in width. Its weight, including batteries and gas supply for portable operation, is about 25 lb.

American Cyanamid does not plan to produce the device, but has made it available to possible manufacturers. While it has had no commercial experience with it, Cyanamid's engineers think it will be possible to manufacture and retail an instrument for under $500.

Other uses . . . Its extraordinary sensitivity makes FICA not only a highly useful tool for determining the effectiveness of catalytic mufflers, but also a potentially useful tool in a variety of other aplications.

Some of these possibilities were described by W. B. Innes and A. J. Andreatch of Cyanamid's Stamford, Conn., Research Laboratories in a paper delivered last week before the Conference on Analytical Chemistry and Spectroscopy in Pittsburgh. Innes, Andreatch, and Raymond Feinland are credited with the development of FICA.

These are some of the other possibilities Innes and Andreatch mentioned:

. . . Engine research. FICA offers a sensitive means of determining the efficiency of hydrocarbon combustion. Small changes in fuel mixture or ignition efficiency result in large changes in exhaust hydrocarbon content which are readily detectable by FICA.

. . . Exploration. The presence of hydrocarbons in bodies of water, soil, rock formations, cores, and even in the atmosphere is readily detectable by FICA. Analyses can be made continuously on the site.

. . . Leak detection. Used with a vacuum pump and test probe, FICA would be useful in detecting leaks in plant or laboratory equipment. It could also be used for detecting leaks in underground natural-gas lines.

. . . Explosive vapors. Because of its ability to detect concentrations as low as ten parts per billion, it is more sensitive than commonly used infrared analyzers. Since it responds to total carbon content, the explosive limit of which is known, it can detect explosive limits.

. . . Plant streams. Obvious applications in determining the hydrocarbon content of plant streams would include gas from methane reforming, inlet gas to ammonia converters, gas from methanol converters, and gas from hydrocarbon synthesis.

. . . Vapor pressure. Innes and Andreatch detailed a procedure for determining vapor pressure of hydrocarbons in terms of total carbon which could normally be correlated with conventional vapor pressure.

. . . Moisture analysis. Since water reacts with calcium carbide to liberate acetylene, which can be detected by flame ionization, the unit can function as a very sensitive moisture analyzer.

Imports Board Denies Quota Appeals

• In decisions from first five appeals, the board leaves no doubt it will be hard nosed in handing out quota increases. It looks as if an "exceptional" hardship case will be the only one to win an increase.

IT APPARENTLY is going to be tough for an oil company to get any relief from the Oil Import Appeals Board.

That was the indication from the board's first rulings on appeals made during this 6-month allocation period. In five decisions announced last week, the board turned down all five applicants.

The firms that had made the appeals were Standard Oil Co. (Ind.), Patchogue Oil Terminal Corp. of New York, Metropolitan Petroleum Corp. of New York, Patterson Oil Co. of Paulsboro, N. J., and Texas American Asphalt Corp.

What's ahead . . . No hard and fast conclusions can be drawn from these five decisions, of course, because each presents a different set of factors.

Furthermore, they are only five of 50 decisions which the appeals board is facing.

Even so, it is a safe bet at this point that few of the appeals will get favorable action from the board.

This is not particularly surprising in regards to appeals for an increase in crude-oil import quotas because the board last year made it quite clear few changes would be made.

But there had been some expectation that the board would now look with more favor on requests for new or increased product-import quotas. This stemmed from the change made in policy last December authorizing the board to grant product quotas to newcomers who could show they were suffering extreme hardship because of the control program.

Thus far, however, it appears that a company faces a difficult task in proving exceptional hardship.

The board has taken the attitude that the mandatory control program, by its very nature, has caused a hardship of some degree to a large segment of the oil industry. Therefore, the fact that a company can show that it is being hurt by controls is not enough. It must show that this is an "exceptional" hardship.

Policy revealed . . . Evidence that the appeals board plans to apply this line of reasoning to product newcomer cases as well as to crude importers is clear in this statement by the board:

"The recent amendment to proclamation 3279, extending the authority of the board to grant allocations of finished products to persons who do not qualify for allocations of those products is circumscribed by the requirement that the board find an exceptional hardship to exist caused by the mandatory oil import program."

The board has also stated that proof of exceptional hardship must be specific.

There is no clear-cut pattern yet as to what the board would consider as "exceptional" hardship. But its action in the first five cases gives some further pointers as to what the board will not consider as hardship cases.

For instance, it turned a deaf ear to the complaint by the Patchogue Oil Terminal Corp. that it (Patchogue) was a "captive" of its fuel-oil supplier because the supplier has the import quota while Patchogue has none. According to Patchogue, this enables the supplier to call the tune because Patchogue, without a quota, can not seek out another supplier.

Furthermore, Patchogue claimed it was the only major wholesaler of residual fuel in the New York area without a quota, thus giving it a further competitive handicap.

But the board, noting that Patchogue had apparently had no trouble in buying foreign residual fuel and noting that its sales had increased since 1957, said it could find no real hardship. So it turned down the appeal.

Other cases . . . Somewhat the same problem was involved in the Patterson Oil Co. case.

Patterson argued that it was at a disadvantage with its competitors because it had to pay more for residual fuel oil since it does not have an import quota. It, too, was turned down by the board.

Those cases, therefore, make it apparent that the "captive" customer argument is useless as a basis for appeal.

Strikes which shut down refineries, thereby causing the company to get a lower quota for the next period, do not constitute a basis for a quota appeal, either.

Or so it was found by Standard Oil Co. (Ind.), which had asked for a quota hike to offset the quota loss it suffered because five of its refineries were shut down for varying periods during 1959.

The board ruled in this case that there was not sufficient evidence that the company's business would be seriously harmed by the reduced allocation resulting from the strike.

In general, it appears to be the board's view in most instances that if a company can absorb a loss, even though that loss admittedly results from unusual circumstances, it is not a hardship case and therefore is not eligible for a quota adjustment.

Some company may seek to challenge this approach in court, but until that happens, it would seem likely that the board will continue to follow that line of reasoning.

The other two cases disposed of by the board last week were so surrounded by special circumstances that the rejection of these appeals would seem to add little to the shaping of a policy pattern by the appeals board.

Texas American Asphalt claimed justification for a crude-import quota on the basis of having imported 50,600 bbl. of crude during the period of a temporary restraining order issued by a Texas court enjoining the collector of customs from refusing to permit importing without a quota.

That is, Texas American Asphalt was able to bring the oil in only because of the restraining order. The board ruled last week that this did not entitle Texas American to an import allocation.

Metropolitan Petroleum Corp.'s appeal was based on the argument that it faces a diminishing crude-import quota because some of the crude it imports bypasses the firm's skimming plant and therefore is not counted in the company's refinery runs. As a result, the company gets a smaller import quota for each import period. The board found this unconvincing.

The board still has a long way to go before it completes its hearings—and reaches a decision—on the remaining appeals before it. And from present appearances, it seems likely that most, if not all, of the companies are going to be unhappy with the results.

Gulf Sale Record

. . . but final tally shows only small amount of the leases up were sold.

STATISTICIANS sharpened their pencils again last week and came up with the final figures on the massive federal sale of leases off Louisiana and Texas (OGJ, Feb. 29, p. 42).

A remarkable fact disclosed by the new—and record-smashing—totals is that only 143 leases were sold of the 385 offered, less than two in five.

Actually bids were received on 173 leases, but rejections and other deficiencies scaled down the total approved.

Of the 288 tracts off Louisiana, only 95 were actually sold. Off Texas it was 97 offered and 48 sold.

The sale brought in $282,111,314.79. This figure was arrived at after deducting $3,069,333.35 which had been offered on tracts and rejected because the bids were considered too low or the required cash was not submitted.

For Louisiana, the total received for approved leases was $246,379,283.59. Of this amount, $57,790,262.57 went for tracts in Zone 3 and $188,589,021.02 in Zone 4. The Zone 3 money goes into escrow with the U. S. treasury until the U. S. Supreme Court decides the tidelands boundary case. The escrow account now has about $340 million, which will go to Louisiana or the U. S. Government, depending on whether the state boundary extends 3 miles or 3 leagues seaward.

For Texas, the total received was $35,732,031.20, all of which goes to the U. S. Government.

The grand total for all 444 bids submitted on tracts in the sale came to $567,463,799.84. Thus, about one-half of this amount ($282.1 million) actually was spent for leases.

The successful bidders were making no grand rush last week to sink holes in their new real estate. They have 5 years to drill and comparatively small rental payments to make.

The industry will watch Shell Oil Co. closely as it tackles its new tracts in the deepest waters ever leased. The four tracts in the South Addition to the Grand Isle area have waters ranging from 240 ft. to 360 ft. deep.

Shell is known to be experimenting extensively with an underwater completion technique, and many engineers believe some sort of subsea completion is the only economic way to produce wells in very deep waters.

watching WASHINGTON

Clyde La Motte

• Military hopes to speed contract letting . . .

THE MILITARY PETROLEUM Supply Agency is hopeful that a combined use of its own brain and a mechanical "brain" will enable it to handle oil purchasing with more efficiency and dispatch.

If this combination is successful, there may be a marked reduction in the time between bid openings and bid awards. This would make both the military and the companies who do the bidding happy, because the closer to a bid opening a contract can be made, the better the supplier and the purchaser are able to judge market and supply conditions.

Ordinarily, it takes at least 6 weeks to determine awards after bids are opened. The reason: Buying teams must prepare handwritten abstracts of each bid and manually compute laid-down prices to each destination from every logical source. This provides an almost endless exercise of the pencil to work out the infinite number of variations.

So now MPSA is going to put an electric computer to work on this sort of number juggling, leaving the buyers free to make decisions on factors that cannot be run through a machine.

The purpose is not only to save pencil work and reduce the time lag between bids and contracts, but also to enable MPSA to consider more widespread sources for each base and terminal. Thus, more bidders will be given a chance.

The computer will be put through a trial run, side-by-side with the normal procedure, to see how well it works out. MPSA has hopes that it will put the new technique into full use by mid-year.

• MPSA gets a bigger role in oil supply . . .

THE MILITARY IS also putting a new supply procedure into effect, beginning this month. In effect, the MPSA will move into the "wholesale" end of distribution.

Heretofore, MPSA has handled the contracting for major petroleum supplies for all branches of the service. Then it turned those contracts over to the individual services for distribution.

Under the new plan, however, MPSA will have full authority and responsibility to select the sources of product and means of transportation, to meet re-supply requirements involving tanker and tanker/barge combination movements to bulk terminals world-wide.

The military figures that this centralization of supply planning will be more efficient. The industry may also benefit. There have been complaints in the past about contract status. That is, one supplier, dealing with the Air Force, may have his contract postponed while a nearby supplier with a Navy contract is called on for additional supplies. With MPSA as the watchdog, the military hopes to be in a position to keep these delays and differences to a minimum.

• Army's multifuel engine tests well . . .

A FINAL—and optimistic—report has been made on a series of tests Army engineers made with a multifuel engine installed in a truck.

The report indicates there are still a few bugs, but that the engine, burning such fuels as gasoline, JP-4, kerosine, diesel, and marine diesel, outperformed a standard gasoline-burning truck.

To get the full report, write The Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Ask for "Multifuel-Diesel-Engine Truck" PB 161114 and enclose $1.

Can Compacts Cut Operating Costs?

• It's too early to tell, but some companies are adding them to their fleets in sizable numbers, and others are trying them out. They can't be ignored because of the push for economy and the rising cost of driving a standard.

OIL AND GAS companies are taking a serious look at compact cars to see if their use will help hold the line on mounting transportation costs.

The "little" cars have hit the scene in force at a time when:

... Operating costs for passenger cars and pickup trucks are at an all-time high and rising rapidly.

... Economy of operations has become the watchword in almost every company in the oil business.

It's estimated that the oil companies operate more than 60,000 cars and pickups for jobs ranging from executive to pumper. And they travel an estimated 820,000,000 miles a year. So, any cut in costs per mile would mean a big saving.

The American compacts, and in some cases the smaller foreign imports, have attracted oil-company interest because of their prospect of greater gasoline mileage, sizable economies in tire and maintenance costs, plus the promise of good off-highway performance.

The compacts already have broken into the company-fleet field in sufficient numbers to attract the attention of the Petroleum Motor Transport Association.

This group has a rate committee which studies automotive costs and prepares each year a rate schedule recommending mileage and hourly rental rates for different classes of cars, primarily for accounting work in part-interest operations. It plans to add the compacts to its 1961 schedule.

Tests under way . . . Texaco Inc. has taken the biggest step so far with the compacts.

It has passed the word that all men below the rank of district superintendent who use company cars will get compacts when their present cars are retired. Its decision followed a 6-month experimental period with compacts in Illinois.

Continental Oil Co. expects to have 100 compacts in use this year. It has already run tests on different models, using selected experienced drivers.

Gas companies, particularly those combining field and lease work with pipeline and urban distribution services, have been using small cars for 12 to 18 months and keeping a close check on performance.

Doubters aplenty . . . In spite of the enthusiasm of the backers of the "little" cars, many transportation men are skeptical.

One major-company veteran whose equipment travels 36,000,000 miles a year, has this to say:

"The 1960 compacts? I'd say no. After they've developed for another year or two and have been given a little more size and power and made more rugged, maybe.

"Sure, we're looking for more economical transportation. Even three-tenths of a cent a mile on passenger cars—when you put the mileage in the millions — is worthwhile. We'll swing to any model, shape or size, when it's proved and when we know from experience it'll do the job. Now, it's too early."

Another major company transportation advisor fears a false economy in compact cars. What is saved in mileage will be lost in eventual trade-in or outright sale value—regardless of savings in original price.

And the importance of "prestige" and of giving "workers who practically live in their cars all the comfort possible," he feels, make standard-size cars a far better deal.

There's still another school of thought. A company is cutting its own throat, these men say, when it endorses, by use, a vehicle that gets along on less of the company's own product, gasoline.

Others take this with a grain of salt. Any legitimate cost-cutting device, they say, is justifiable.

Compacts on trial . . . Just about every company, directly through its own fleets or indirectly through employe-owned cars, is checking out the compacts.

Most results to date are considered inconclusive, as they represent only a

Rising Automotive Costs Make the Compacts Attractive

MILEAGE rates for automobiles have jumped 2 cents in the last 4 years — the same amount they increased during the previous 16 years.

New rates for 1960 are 8 cents a mile for Fords, Chevrolets, and Plymouths, and 9 cents for larger cars.

These annual rates have been set for many years by the Petroleum Motor Transport Association as "suggested maximum automotive rates for use in part-interest operations." The PMTA rates are recognized throughout the industry and are included in joint-interest contracts. The jump in recent years has put the spotlight on compacts as a possible means to check the advance, if not cut it back.

	1956		1957		1958		1959		1960	
Class	Per mile	Per hour	Per mile	Per hour	Per mile	per hour	Per mile	Per hour	Per mile	Per hour
Chevrolet Ford Plymouth	.06	.70	.065	.80	.07	.85	.075	.90	.08	$1.00
Dodge Oldsmobile Mercury	.07	.80	.075	.90	.08	.95	.085	1.00	.09	1.10
Buick Chrysler DeSoto Pontiac	.07	.80	.075	.90	.08	.95	.085	1.00	.09	1.10
Station Wagons	.07	.80	.075	.90	.08	.95	.085	1.00	.09	1.10

few months of experimentation. To really study engine wear, over-all maintenance needs, and general durability, a 3-year period is considered a necessary minimum.

Continental put experienced drivers in a few compacts. It's keeping detailed box scores on each vehicle. Only result to date is to discount mileage claims made for the new American cars.

Instead of the 30 miles per gallon advertised, Continental says its best mileage to date is 21 per gallon, and this was highway driving. Other companies have reported a range of 14 to 21 miles per gallon for the compacts.

It doesn't take a remarkable figure to be attractive, since the average mileage for all oil-company cars is estimated at 14 miles per gallon.

A department head of one company which owns more than 3,000 passenger cars is making some tests with his own compact. In the first month the car travelled 1,511 miles, mostly on blacktop, gravel, and lease roads in Indiana and Illinois. Operating cost was 4.67 cents a mile.

A Texas-based service company a year ago substituted two foreign-built small cars for two standard pickup trucks in the Four Corners area.

"We've got 37,000 miles on one and 36,000 on the other—and we wouldn't use anything else," the superintendent said last week. "Not only do they do the job, but they negotiate the terrain with less difficulty than standard trucks."

A gas company with 24 compacts in its 618-car fleet, shows this cost breakdown:

	Costs per mile
Rental cars (standards)	8.318
Standard passenger cars Ford, Chevrolet, Plymouth class)	7.09
Compacts (Rambler and Lark class)	5.98

The figures include all costs, direct and indirect, and depreciation.

Trade-ins? . . . The unknown trade-in value of a compact is deterring some companies otherwise interested.

Policies vary. Some companies trade their old cars in; others act as their own agents and sell them for cash.

One company last year reported an average return of $479 for each standard car retired either after 3 years' service or 70,000 miles.

Say the compact enthusiasts: Initial price is $400 to $600 below the standard models, and this would more than offset any loss in trade-in value.

Good in the field . . . Biggest reason, outside of economy, that makes the compacts attractive to oil men is their performance in the field.

The shorter wheelbase, they say, makes for better off-highway going and for fewer high centers on rutted lease roads. The long overhangs on front and rear of standard cars increase the maintenance expense because of ripped-off gasoline tanks and damaged front and rear bodyworks.

They also think the smaller cars have better flotation and won't mire down so quickly when the going is soft.

Right now the compact's future in the oil business is uncertain. But if a year's experience shows economy of operation, low maintenance, acceptance by company personnel, and any plus factors in the field, 1961 may see a big swing to compacts in the oil-company fleets.

And, say the transportation men, it's about time something were done to slow down the rising cost of their automotive fleets.

Economy isn't new

USE OF compacts and foreign imports aren't the first efforts to cut costs with low-gallonage transportation.

Several years ago Shell Oil Co. bought two motor scooters for field men in the Ardmore, Okla., area. On good roads, the scooters weren't too bad. On a lease's dirt lanes, said the oil workers, they were "impossible."

They provided cheap transportation, but their riders lost "prestige" and morale suffered. After a few months' trial, Shell sold the scooters to a California refinery for plant transportation.

Relief Well Aimed at Louisiana Blowout

• Union Producing hopes to flood out burning well fed by high-pressure gas sand. The directional well has only about 1,000 ft. to go.

OPERATORS of a costly wild well in South Louisiana have their fingers crossed this week as a relief well moves toward a high pressure sand which has fed the high-spouting flame at the surface since January 12 (OGJ, Jan. 18, p. 51).

Union Producing Co., owner of the blowout-plagued operation, hopes the directional well will hit the top of the producing sand and make it possible to halt the flow with water and mud. The hole will be vertical when it touches the sand.

The relief well, located 1,000 ft. from the blowout, is now below 11,000 ft. and will go to around 12,600 ft. Later it may be necessary to move into a lower sand because the well was completed as a dual oil-and-gas producer.

Continental Drilling Co., New Orleans, is the contract driller on the relief hole with its No. 7 inland mobile barge. Continental's No. 5 barge (Belle Claire) was destroyed in the blowout and the fire that followed.

After the blowout, efforts by firefighter Red Adair to bring the well under control failed. Every flange at the water level and above it spewed flaming oil or gas, and it was virtually impossible to get inside the casing to the two tubing strings to shut off the flow.

Pressures of 6,900 psi. and 6,400 psi. had been recorded prior to the blowout.

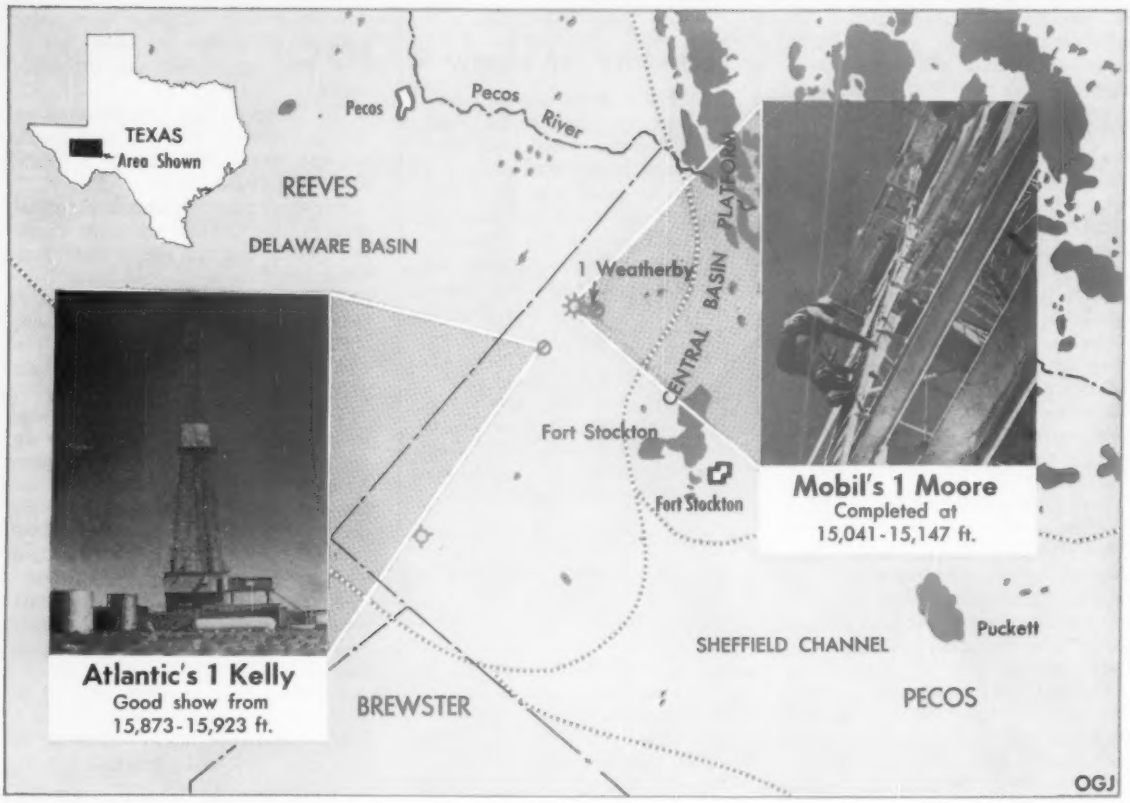
The well is located in Deer Island field, Terrebonne Parish, 18 miles south and slightly west of Morgan City.

One fight over . . . Meanwhile, the final chapter on another South Louisiana blowout has been written. The 1 Nunez of Trice Production Co. in Theall field, Vermilion Parish, has finally bridged over.

The well blew out last October 29 and destroyed a rig of Bayou Drilling, Inc. When control efforts failed, the operators decided on a relief well to the 12,304-ft. depth. The 1-A Nunez was spudded in late November, but just before it reached the producing sands, the 1 Nunez bridged over.

The 1-A Nunez has now been completed at 11,882-86 ft. as a gasser flowing at 1,750,000 cu. ft. daily, with 25 bbl. of distillate to the million.

Bayou Drilling was the contractor on both wells, located 10 miles southwest of Abbeville.



Two Gas Strikes Spotlight West Texas

• The major oil and gas play of the year appears to be shaping up in the Delaware basin following two deep wells by Mobil and Atlantic. The developments will spur activity all over the Val Verde and Delaware areas.

THE U. S. oil industry probably is seeing now developing the biggest new oil and gas play of the year.

Two significant developments have the industry's attention focused on Pecos County in the Delaware basin of West Texas.

One is the completion by Mobil Oil Co. of its 1 Kathleen Moore as a big gas-distillate strike—very likely to be the year's most significant.

And not far off, Atlantic Refining Co. is drilling ahead at 18,316 ft., expecting to hit the Ellenburger soon, in its 1 J. C. Kelly, a wildcat which already has found big gas in the Devonian. The Devonian find, with best flow from the interval 15,873-923 ft., sets up the 1 Kelly as West Texas' deepest producer and the second deepest in the state. An Ellenburger strike would make it the state's deepest.

These are the two most critical things that have happened in the entire Delaware and Val Verde areas since Puckett and Brown Bassett fields. The finds will greatly accelerate interest and activity all over that vast area.

A Mobil geologist says he thinks the two big strikes—coming practically at the same time—will be the trigger to kick open the Delaware basin, where exploration has been stimulated periodically in the past by an occasional deep well, only to die down after a brief flurry of activity.

He adds that the 1 Kelly already has kicked off a tremendous land play in the area.

The 1 Moore . . . The Mobil discovery is described as "a gas field of really significant size" by Fred H. Moore, Mobil vice president in charge of exploration and production.

The company has roughly 20,000 acres under lease in the area, and about 6,000 acres of that are believed to be on the structure.

Mobil's 1 Moore is located in Section 19, Block 48, T-8, T&P Survey. It is about 22 miles northwest of Fort Stockton and about 15 miles northwest of Fort Stockton field. There is no production closer than this, other than two small shallow fields, Coyamosa and Hew.

The Mobil well was completed for a calculated, absolute open-flow potential of 102,000,000 cu. ft. of gas a day and a gas-liquid ratio of 66,000:1. This would mean distillate capacity of more than 1,500 bbl. daily.

Production is from perforations in the Pennsylvanian at 15,041-15,147 ft.

Surface flowing pressure through a 9/64-in. choke was 10,240 psi. And surface shut-in pressure was clocked at 10,410 psi. Bottom-hole shut-in pressure, gaged at an astonishing 12,590 psi., is believed the highest ever recorded in West Texas. This would appear ample evidence that the Mobil strike is no flash in the pan.

Total depth in the 1 Moore was 15,300 ft. And plugged-back total depth is 15,256 ft.

The spectacular test has hogged the West Texas limelight periodically for many months. Its first big splash came when it flowed oil from the Wolfcamp from 10,890-895 ft. at a rate of 175 bbl. in 13 hours.

Later, when it reached 15,017 ft., the project blew out in the Pennsylvanian. Part of the drill string was lost. Mobil, unable to recover the fish, sidetracked the hole at 12,676 ft. and redrilled to the Pennsylvanian.

The company decided not to test the Wolfcamp due to poor hole condition. The fishing job and resultant running of a string of 7-in. casing at 13,930 ft. also forced the company to cancel its plans to carry the hole below 20,000 ft.

The deep probe is being tackled by an offset confirmation well, the 1 Ivy Weatherby, five-eighths of a mile east of the Kathleen Moore. The 1 Weatherby, located NE of SW Section 20, Block 48, T-8, T&P Survey, is drilling below 4,600 ft. It is projected to 20,000 ft.

The 1 Kelly . . . Atlantic's 1 Kelly is virtually assured of taking over the title of Texas' second deepest producer when the drilling phase is completed.

Deepest production in Texas is on the Gulf Coast. Pure Oil Co. holds the record with its 1 Houston Farms Development Co. in Galveston County. The well was completed in the Frio late last year for gas-condensate at 16,264 ft.

The 1 Kelly, as West Texas' deepest producer, would displace Mobil's 1 Moore from that position—which in turn has just taken over from Puckett field producers more than 50 miles to the southeast. The Puckett wells produce gas from the Ellenburger at roughly 15,000 ft. Puckett also has the nearest other Devonian production.

The Atlantic project, located 30 miles west of Fort Stockton, drill-stem tested the Devonian late last year. Gas flow through ½-in. top and ⅝-in. bottom-hole chokes was estimated at 15,000,000 cu. ft. daily.

Atlantic used a nitrogen blanket in the test and a regulator to insure against collapsing the drill pipe. Pressure readings taken during the test thus are difficult to interpret. Surface pressure was gaged at 1,650 psi. in 35 minutes. Final bottom-hole flowing pressure was 4,220 psi. And final bottom-hole shut-in pressure was 7,220 psi. in 30 minutes.

The 1 Kelly was making good time last week in what company geologists felt to be Simpson limestone. They hesitate to predict top of the Ellenburger for lack of any data on which to base such predictions but obviously feel the bit might penetrate it any time now.

Closest hole to the 1 Kelly was Humble Oil & Refining Co.'s duster, the 1 Stone, 10 miles southwest. This well topped the Devonian at 13,110 ft. and the Ellenburger at 15,500 ft.

Atlantic exploration experts believe the wildcat is on a large structure. Operator has a relatively solid block of 17,200 acres surrounding the well. The test is a 100% Atlantic operation.

Rig on the project is a big diesel-electric unit owned by Great Western Drilling Co., Midland. It's the same rig which carried Shell's 5 Rumderger at Elk City, Okla., the world's second deepest hole, to 24,002 ft.

Texas' Claytonville Canyon Unit Nearer

• Approval covers plans for a pressure-maintenance program to increase total recovery in the Fisher County field by an estimated 29%.

TEXAS has added another giant to its growing list of big, prolific pressure-maintenance projects.

The Railroad Commission flashed its green light for operator plans to unitize interests in Claytonville Canyon field in West Texas' Fisher County. Its approval covers unit plans to launch a pressure-maintenance program which will hike ultimate recovery from the reef by an estimated 41,000,000 bbl. of oil.

General Crude Oil Co., Houston, as unit operator, will direct the project.

C. R. Burney, company vice president and chief engineer, says the Claytonville operators estimate original oil in place in the Canyon pay at 135,000,000 stock-tank barrels. But continued primary operations will recover only about 25,330,000 bbl., or about 18.7%.

The planned pressure-maintenance program, Burney says, would boost total recovery to 66,480,000 bbl., or 48% of that originally in place. The program, he estimates, would cost the unit about $650,000 to install required injection facilities. Countering this would be an increase in net working-interest income of $91,000,000.

Unit flood plans . . . The unit plans to proceed immediately to reenter a dry hole on the west side of the field and complete it for water-injection service.

At the same time, it will drill a 4,600-ft. water-source exploration well within the unit bounds. Burney says the unit expects to find an adequate source of salt water to supply the entire operation in one or more formations between 2,800 and 4,600 ft.

The unit feels that the reservoir is a very good water-injection prospect. Interference tests have shown an excellent degree of communication between the 47 producing wells in the field. Burney says there never has been, since the field discovery in January 1952, a spread of more than 80 psi. in reservoir pressure between the well with the greatest pressure and that with the least.

Pressure dropping . . . So far, average reservoir pressure has fallen 297 psi. below the original figure of 2,335 psi. with cumulative production of 6,629,707 bbl. of oil, 6.8 billion cubic feet of gas, and 134,415 bbl. of water.

Though this is not a great drop, the important thing is that average pressure now is 217 psi. below the saturation pressure of the reservoir fluid, Burney says.

This, he says, is liberating gas in the reservoir and causing a rapid climb in produced gas-oil ratios, waste of reservoir energy, loss of reservoir fluid mobility, and curtailment of allowables.

Present methods of operation, Burney says, will cause further decline in pressure, thus aggravating all of these undesirable effects. The flood program is needed to head this off.

The new Claytonville Canyon Unit takes in more than 3,200 productive acres. It has 33 operating-interest owners. Among them, besides General Crude, are Pure Oil Co., Sun Oil Co., and Imperial Production Co.—all of which urged approval of the unit and flood.

Of its 47 producing wells, 43 are flowing and four pumping. They produce from a reservoir roughly 5 miles long and 1 mile wide, averaging 155 ft. in thickness.

Average depth of the elongated anticlinal reef pay is 5,700 ft. Its major axis trends northeast-southwest.

PHOTOS IN THE **NEWS**

Tough Pipelining

THE $24-MILLION, 16-in. trans-Israel oil pipeline scheduled for completion in June is shown being laid through rugged terrain of the Negev on its way from Eilat on the Red Sea to Haifa on the Mediterranean. Pipeliners will be interested in the archaic methods used on the line. The workman is filing a bevel by hand and he doesn't have the tremendous help of sideboom tractors.

An international syndicate headed by Baron Edmond de Rothschild will own and operate the 257-mile long line upon its completion by the Israel Government. Major participant in the project with a $2.5-million investment is Palestine Economic Corp., New York.

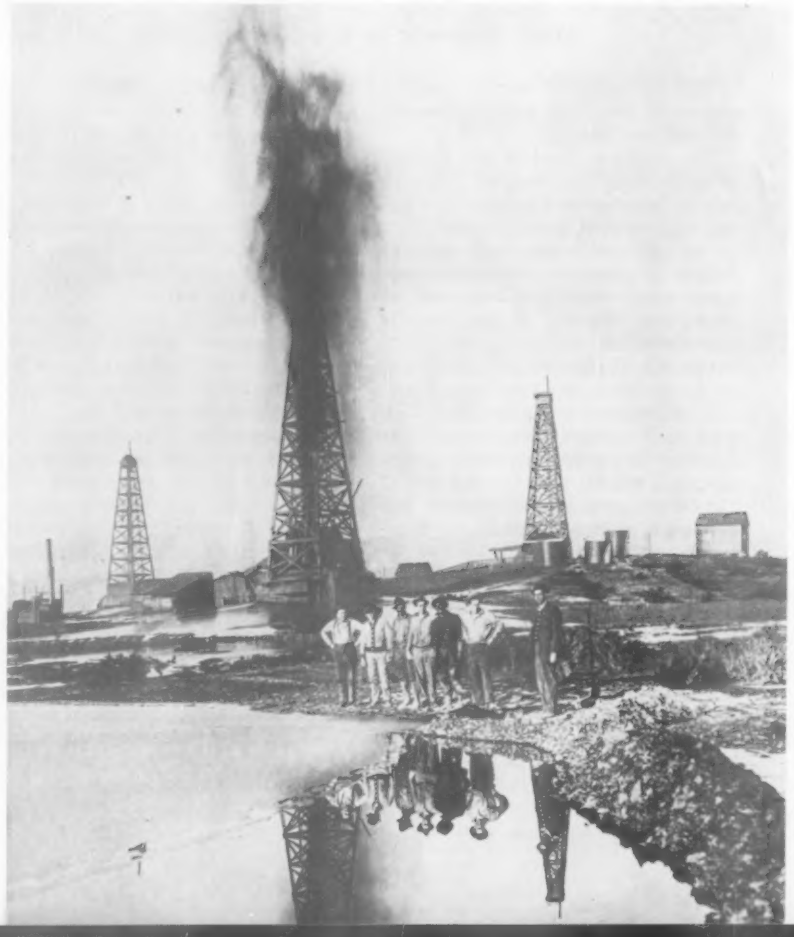
Birthday of Gusher

IT WAS 50 years ago on March 14 that the country's biggest gusher blew in—the famed 1 Lakeview of California's Midway-Sunset field.

The Union Oil Co. well produced more than 9 million barrels of oil, 4 million of which were lost to evaporation and seepage in tremendous earth reservoirs hastily built. The torrent of oil broke domestic prices, driving them down to 30 cents a barrel.

Union settled damage suits for years afterwards because the 2-ft. wide, 200-ft. high geyser of oil drenched everything for 15 miles around. Engineers estimate the well made 125,000 bbl. the first day and then settled down to 90,000 bbl. daily for at least a month.

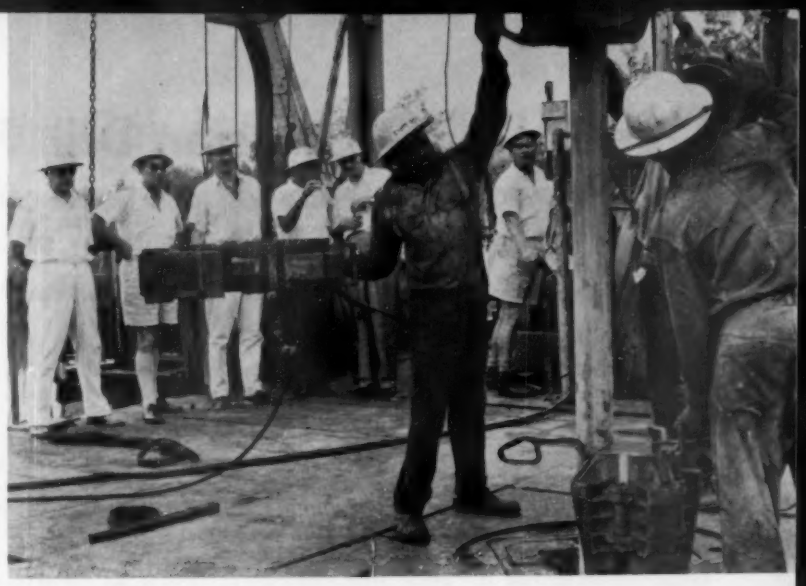
The 1 Lakeview, however, died almost as dramatically. It caved in suddenly on September 9, 1911. Union later redrilled the well, but the new 1 Lakeview never made more than 35 bbl. daily on the pump on its best day.



Inspection Day

A NIGERIAN drilling crew on Shell-BP Exploration's Barge 1 shows off its skill to Sir Neville Gass, chairman of British Petroleum Co., during his inspection of company projects. Gass is shown fifth from left above.

The barge is on location at Santa Barbara in the Niger River Delta. Recently as many as two out of three wildcats in Nigeria have been coming in as field discoveries.



Aluminum Gets Test

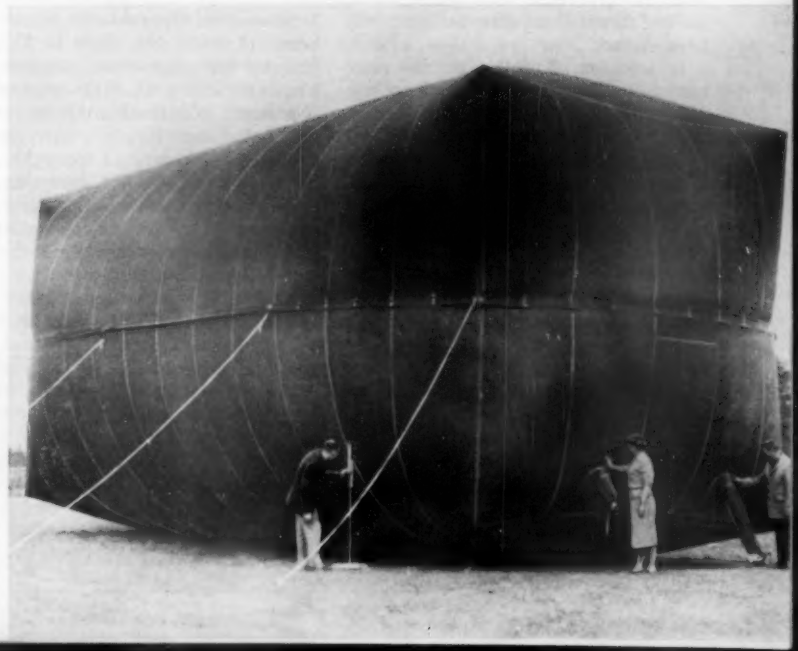
AN ALUMINUM pipeline is being given a field test in Louisiana. Columbia Gulf Transmission is installing a 1-mile section of 6-in. aluminum pipe in its gas-gathering system at Cameron, La. The line will feed gas ultimately into the company's 841-mile pipeline between Rayne, La., and Leach Station, Ky.

Workmen are shown pulling a 40-ft. length of Alcoa Unistrength pipe through a welding machine toward the ditch following completion of a joint.

Vapor Bag

THIS 20,000-cu. ft. breather balloon is test inflated before shipment overseas where it will be installed at a refinery to conserve expanding vapors from gasoline in storage.

In operation, the bag will be suspended off the ground inside a shelter. Vapors will be piped off storage tanks into the bag through two aperture sleeves in foreground. The giant lung was made at Garrett Corp.'s Belmar, N. J., plant.



Mud-Driven Percussion Drill Field Tested

• Continental-Emsco sees mud hammer as a way to keep the bit on bottom longer and cut round trips. However, more field tests are needed before the new tool can be fully developed and ready for market.

CONTINENTAL-EMSCO CO. has completed first field trials of the mud-driven percussion drill which it has had under development for the past 2½ years. Results of the test were described as "inconclusive" by company officials.

The manufacturing-supply firm is investigating the tool under a license from Gulf Research & Development Corp. which devised it. These first field trials followed months of intensive engineering and laboratory-testing work though actual on-bottom time was only 24 hours. The work was conducted in an Oklahoma wildcat.

Following the test, the percussor was taken back to the factory at Garland, Tex., for modification. Field testing will resume this month.

Announcement of the test program was made last week in Houston at a company sales meeting by William T. Powell, executive vice president in charge of engineering and manufacturing. If the upcoming tests are successful, Powell said, it may be possible to market a production model before the year's end.

Powell said that prime purpose of the mud hammer is to lengthen the time a rock bit can economically spend on bottom. If the tool succeeds in this, it would cut drilling costs by cutting the number of round trips required. The expected lengthening of economical bit life, Powell said, is the result of an unexpected action: The percussor results in a sharpening action on bit teeth that keeps them drilling cleanly long after ordinary bits have dulled.

In addition, Powell said, this mud hammer seems likely to speed drilling rates significantly.

Bypass in advance . . . Continental-Emsco officials say that the tool now being tested is considerably different from the original Gulf design on which they took license (OGJ June 10, 1957, p. 70). Valving has been rearranged for more reliable action.

One of the biggest improvements in the tool, Powell said, is addition of a bypass arrangement. When the percussor is run into or pulled from the hole, mud flows through the bypass rather than through the operating parts of the percussor. Thus, no complications are caused by hammer action during trips.

When the bit reaches bottom and mud pumps are started, the bypass closes and circulation is through the mud hammer.

Powell emphasized that use of the mud hammer requires no additional equipment to the rig. Pumps and drill pipe are the same as for conventional rotary drilling. In the event that the hammer fails to function when it is on bottom, drilling can continue with normal rotary practices.

If the hammer is successful, Powell said, it will likely cut down on drill-collar needs for the rig. It's likely, he said, that the rig could drill as fast using 25,000 lb. and the hammer on the bit as it could using 40,000 lb. without the hammer. Drilling with lighter weight also means drilling straighter hole.

Old principle . . . Drilling-equipment men have long dreamed of combining the percussion action of the cable-tool rig with the roller-cutting action of the rotary rig.

Although patents for devices intended for this purpose go back almost to the turn of the century, the first commercially successful percussion drilling tool has been marketed for less than 1 year. This tool, however, is air driven and can be used only when drilling with air or gas.

Perfecting a mud-driven percussor has been more difficult. Even if the mechanical problems of a mud hammer are successfully solved, there remains the task of proving the tool more economical than conventional rotary drilling. Tool rental and extra cost of pump maintenance (resulting from higher pump pressures) must be balanced against extra bit footage, increased drilling rate, straighter hole, and fewer drill collars.

Major component of the hammer tool is a free solid-steel cylinder or hammer. As mud flows through the tool, it alternately raises the hammer and then drives it down against an "anvil" above the bit. These rapid hammer blows, many believe, should add greatly to the cutting ability of conventional bit teeth.

Several major oil companies and oil-equipment manufacturers have attempted to develop variations of the percussion drill for use in mud. Some have been high-speed devices driven by electric power (magneto-strictive) or mud engines (sonic drill). Others have been slower speed machines with mud acting directly on the hammer. Thus far, all such efforts have been unsuccessful because of failure to develop a completely reliable tool, regardless of any improvement in drilling action.

INDUSTRY BRIEFS . . .

Kansas' oil allowable for March has been cut 5,000 bbl. daily to 325,000 bbl. by the corporation commission. Chairman Harry G. Wiles said excessive stocks of refined products caused the reduction. Kansas aboveground storage on February 13 was 9,335,000 bbl., down 217,000 bbl. from January 9. In cutting the allowable, prorated and restricted wells will be held to a 25-bbl. maximum and unprorated wells to a 25-bbl. lease average.

The Panther Creek Gibson Sand Unit in Garvin County, Oklahoma, became effective March 1 with Phillips Petroleum Co., as the operator. There are 78 Gibson sand wells on 3,120 productive acres in the unit.

Increase in Oklahoma's state depletion allowance from 20 to 27½% has been recommended by the committee on revenue and taxation of Oklahoma's legislative council. A bill, for such an increase was rejected by the 1959 Oklahoma legislature. The state tax commission estimates the increase would cost the state about $1 million in tax revenues a year.

Producing Properties, Dallas, has moved to expand its production in California with two more purchases. The company paid $1,756,000 to Morrow Oil Co., Los Angeles, for its interests in 180 wells in 17 fields in California, Texas, and New Mexico. The major properties included leases in the Morales and Rosecrans-Athens fields in California and the Jalmat area of Lea County, New Mexico. In the second deal, Producing Properties bought 47 wells on 11 leases in Ven-

Two Bidders Sweep Gubik Sale for $206,027

- Discovery well of the Gubik structure is on one tract won by Hunt Oil.

WITH a disappointing number of bidders competing, Hunt Oil Co. of Dallas and Colorado Oil & Gas Corp. of Denver won all 16 tracts totaling 9,000 acres offered for leasing in the Gubik area of northern Alaska.

Winning bids totaled $206,027. Tracts ranged in size from 640 to 260 acres. Bid prices per acre varied from about $1 to $45.37 per acre, averaging $22.63 per acre.

Hunt won 10 tracts with total bids of $160,525. Colorado Oil & Gas won six tracts at cost of $45,502.

All the tracts are concentrated near the Colville river northeast of Umiat. They are east of and adjacent to the Navy's Petroleum Reserve No. 4 with portions on the East Gubik anticline. On other sides of the region lie lands already leased. One tract won by Hunt includes the 1 Gubik gas well which discovered the structure.

Neither of the winning bidders indicated they had any early drilling plans. Colorado Oil & Gas has two idle rigs in the Gubik area. Company officials had indicated earlier they would drill for gas if they won sufficient acreage to warrant the drilling. Market for the gas, however, depends on feasibility of a pipeline to serve Fairbanks and military installations there. Coal deposits in the Fairbanks area presently supply the heating market.

The two Gubik gas wells were drilled by the Navy several years ago to depths of 6,000 and 4,620 ft. The No. 2 well blew out while casing was being settled for production tests. The rig was destroyed by the resulting fire, and gas flow during the blowout was estimated at 50,000 M.c.f. daily. Wells in the Gubik area probably can be commercially produced at the rate of 10,000 to 15,000 M.c.f. daily.

Only other bidders besides Hunt and Colorado Oil & Gas were Jane P. Wold of Casper, Wyo., John J. King of Portland, Ore., and Kenneth A. Murray, Fairbanks.

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tura, Kern, and Los Angeles counties from Great Lakes Oil & Chemical Co., Los Angeles. This one, the company said, added 620 bbl. daily to its California production and about 600,000 net barrels to its reserves.

Drilling of 10 new wells by late spring in Wyoming's Teapot Dome field is expected to double production from the present 230 bbl. to about 470 bbl. daily. The U. S. Navy has jurisdiction over the field and has contracted with Intex Oil Co., Bakersfield, Calif., to drill the wells along the eastern border of the reserve, about 12 miles southeast of Midwest. Nine wells now are producing.

Heiland Exploration, Ltd., of Calgary, struck gas while doing seismic work on a 2.7-million acre tract in the Canadian Northwest Territories for Atlantic Refining Co. The 275-ft. hole struck the gas February 19. The gas was ignited and flames reached a height of 40 ft. Four days later the flow was undiminished. The location is about 35 miles west of Fort Good Hope and 10 miles south of the Arctic Circle.

Continental Oil Co. will spend $1,275,000 building underground storage for 200,000 bbl. of LPG at its tank farm adjoining its Ponca City, Okla. refinery. Fenix & Scisson, Tulsa, will build the cavern in a limestone formation 350 ft. deep. Excavation will be through a vertical shaft. Off-season storage of propane is planned.

Delhi-Taylor Oil Corp. has purchased a "substantial common-stock interest" in Billups Eastern Petroleum Co., an independent marketer with 145 retail outlets on the East Coast from Delaware to Florida. While the interest is said to be less than 50%, Delhi-Taylor will be represented on Billups' board.

The federal Government was paid almost $112 million in royalties in 1959 on oil and gas leases it supervises on federal properties. These are on public, acquired, Indian, military, and Continental Shelf lands. The Government had 156,539 oil and gas properties under supervision, covering 121,447,781 acres in 32 states, with production amounting to about 253,987,000 bbl.

Shell Oil reportedly has paid more than $2 million for drilling rights on 88,000 acres in eastern Utah and western Colorado. The deal was made with Neville G. Penrose and James L. Tatum, who have a Fort Worth, Tex., oil partnership.

How California Independents Are Faring

• The state's small producers have seen some rough times, and none sees a rapid upturn. However, there are slightly encouraging factors.

CALIFORNIA'S small independent producers have been having rough sledding in recent years. But there's at least some indication that the future promises improvement.

Several independents expect conditions to improve, rather than get worse, because of cost-cutting methods and a slightly brighter spot here and there in the stocks and price picture.

But right now, they're in a bind. A look at the annual reviews during the last 6 years of the Conservation Committee of California Oil Producers points up their plight.

The small independents have lost the most ground in state oil-well completions. They completed only 26.9% of the new wells during 1959, compared with 57.7% in 1954.

The big drop came in 1959. The independents completed 238 wells that year, compared with 646 by the majors. The year before, the small operators were ahead of the majors, 510 to 468.

The drop in completions will be felt down the road in the independents' share of production and number of producing wells. The independents have been losing ground to the majors in these categories, but not as sharply as in the number of completions.

The independents accounted for 42% of the state's production in 1954. Today, their share is 39%. They're now operating 50% of the state's producing wells, compared with 52% 6 years ago.

What's happening . . . The independent is caught in a squeeze between rising costs, lowered income, and poor prospect of peddling any new production.

Here's what the little producers face in California:

. . . Crude prices. Prices have dropped as much as $1 a barrel in the last 2 years. The bulk of the independent-produced crudes come from low-gravity fields, which have been hit hardest by price cuts.

In addition to the posting slashes, independents claim as much as 90,000 bbl. daily is going for discounts up to 70 cents a barrel.

However, on a brighter side, there's been a notable absence of talk recently about changing crude prices in California. And some economists even made a little case for a modest price rise in heavier crudes, although there's no such talk among purchasers.

. . . Contracts. Independents report there had been a growing trend by purchasers of not renewing contracts. However, almost all add that their purchasers are continuing to take their crude, but on 15-30-day cancellation contracts or just a day-to-day basis.

The independents point out it would be foolish to try to develop additional production under these conditions.

However, the rash of contract cancellations and nonrenewals appears over and producers still are able to peddle their crude. But the large quantities being sold on day-to-day and short-term contracts and discount sales illustrate there's a lot of room for improvement.

There also has been talk of a possible ratable-take bill for the state. No one is ready to flatly predict that such a bill will find unanimous favor among little producers. But just the fact that the talk existed is a major departure from past experience among independents in the state.

Delayed payment . . . One interesting gimmick attracting attention of hard-pressed producers has popped up in the Los Angeles basin.

Monarch Oil Corp., a new company, was passing the word that it would buy crude at posted prices from little producers, providing the producer was willing to take part of the price at the time of delivery to the refinery and the balance after the sale of the finished product.

Monarch has an option to buy the shutdown 5,000-bbl. Olympic refinery in Long Beach. A spokesman for the company says it plans to upgrade the plant to turn out asphalts, lube oils, and middle-of-the-barrel products.

The banks report an unusual number of companies selling off their production, six in recent weeks, but not an unusual number of requests for stretching out loan repayments. Brokers say there's little or no interest in farmouts in oil counties, but that such deals in gas counties get a little more attention from the independents.

Future brighter . . . Several factors point to better days ahead.

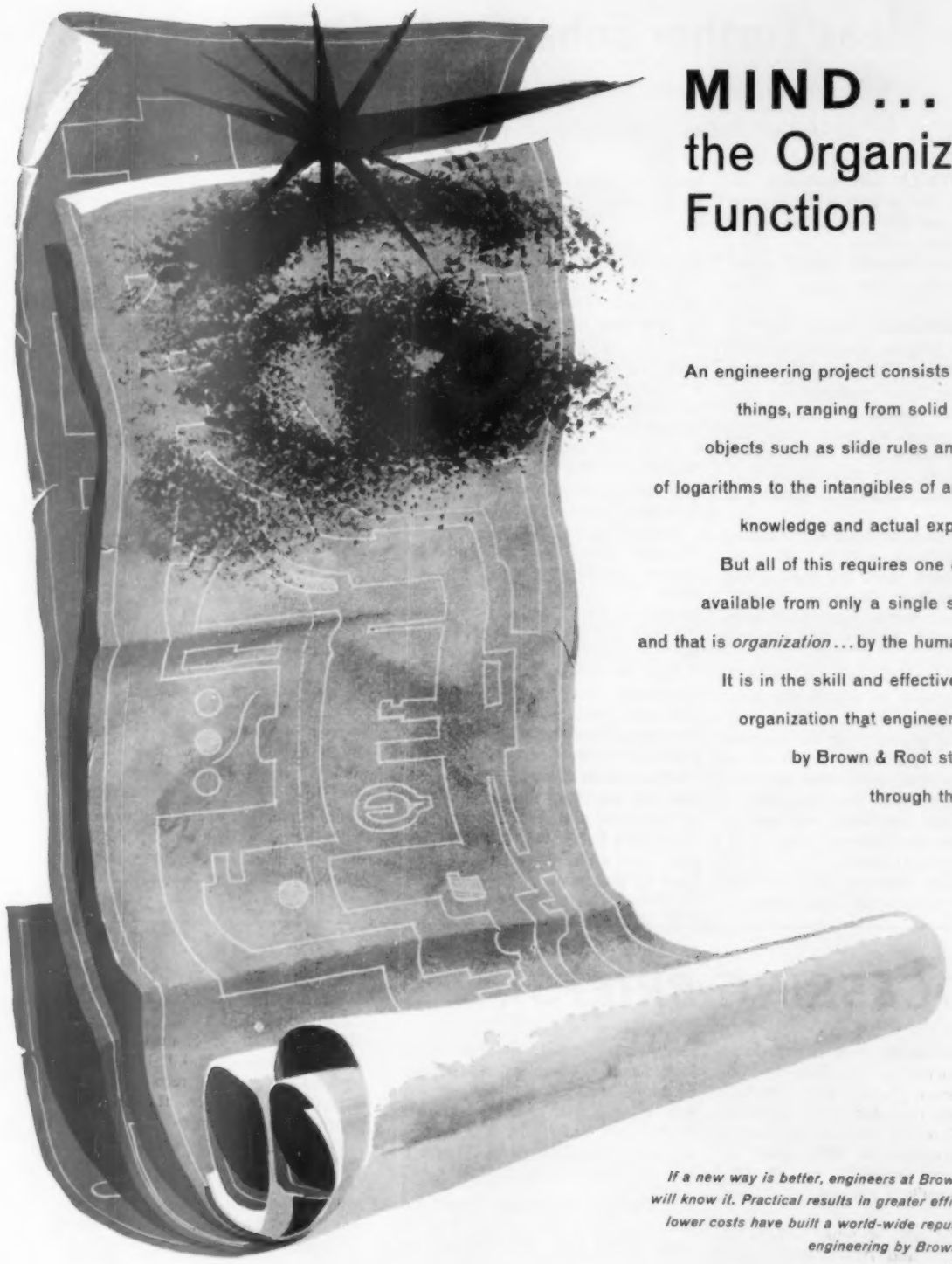
Both crude and residual-fuel stocks were in better shape than they've been in for several years. Preliminary figures for the end of January showed District 5 fuel-oil stocks at 18,361,000 bbl., compared with 29,862,000 bbl. a year ago. This could mean better days for the independent who produces heavy crude.

The independents haven't been able to do anything about rising manufacturers' and labor costs, but a number report substantial savings by careful engineering of drilling operations and by paring nonoperating costs.

A look at independents and majors in California

	PRODUCTION (Average bbl. per day)			COMPLETIONS (Includes only oil wells)			PRODUCING WELLS		
	Majors	Independents	Total	Majors	Independents	Total	Majors	Independents	Total
1954	561,725	413,249	974,974	671	995	1,666	14,969	16,314	31,283
1955	557,245	414,842	972,087	648	1,134	1,782	16,316	17,237	33,553
1956	556,027	402,316	958,343	828	912	1,740	16,974	17,788	34,776
1957	547,970	381,001	928,971	809	883	1,692	17,468	18,299	35,767
1958	449,752	359,623	859,375	468	510	978	17,007	18,029	35,036
1959	504,302	333,688	838,000	646	238	884	17,746	17,951	35,697

All statistics exclude unit-operated wells and production.



MIND... the Organizing Function

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New Ideas Further Enhance Air Drilling

• Faster drilling rates and two new approaches to solving water problems in air-drilled holes are reported to API production meeting in Dallas.

NEW TOOLS and materials are lengthening the already-wide gap between air and gas drilling and conventional mud drilling.

... **The air hammer** drill is speeding penetration rates from 50 to 200%.

... **A drill-collar** packer now on the market permits squeezing a water zone without pulling the drill string.

... **A new liquid** chemical has shut off water in vugular formations.

These disclosures were made last week by speakers at the annual spring meeting of the API Division of Production's southwestern district at Dallas.

H. F. Downs, of Technical Drilling Service, Midland, said the air hammer has been used to drill about 60,000 ft. of hole. Moreover, he said, the hammer keeps air-drilled holes straighter and enables bits to drill farther.

Downs cited five wells in the Permian basin area in which the hammer had been used recently. On these, he said, the pressure of air required with the hammer tool was about the same as without, except that an extra 10 to 20% volume was necessary to carry out the additional cuttings resulting from the faster drilling.

F. W. (Smoky) Smith, also of Technical Drilling Services, discussed the drill-collar packer and other developments in reporting for the district's study committee on air and gas drilling.

The packer, he said, can be inflated by dropping a go-devil into the drill string and applying pressure at the surface. Then, it can be collapsed by removing the pressure.

Thus, he said, the hole can be squeezed without pulling the pipe and a water zone can be quickly and economically squeezed off in an air-drilled hole. The packer which makes this possible was developed by Halliburton Oil Well Cementing Co. and has already been used in the field. It is in the field and available for use.

Smith disclosed that two water-shutoff jobs have been performed with the new liquid chemical. Both water zones are vugular, he said, a type of formation which has resisted squeezing efforts in the past. Both jobs with the new liquid were successful.

The water-shutoff material most commonly used now is less than a year old, Smith said. This material, silicontetrafluoride gas has been successful in 75% of all cases.

"Down-hole fires," Smith conceded, "are the big thing in air-drilling safely." In the past year, he estimated, there have been about a dozen down-hole fires while air drilling in various parts of the country.

"You occasionally get all the necessary elements for a fire: Air under pressure, hydrocarbons, and an elevated temperature. The best way we can see to upset this combination," Smith said, "is to reduce the bottom-hole temperature. And, by 'mist drilling' you can do this fairly easily."

"Mist drilling" is a technique of injecting water and chemicals into the input air stream while air drilling. Purpose of "misting" is to prevent cuttings from balling up and to lubricate the drill string. Reducing bottom-hole temperature could be a very important side effect.

Mississippi Purchases Cut

ESSO STANDARD, Division of Humble Oil & Refining Co. has cut its purchases of Mississippi crude by 15% because of lower product demand.

The proration means Esso Standard will reduce its buying of light crude in central and south Mississippi fields by about 11,000 to 12,000 bbl. daily. The company bought about 75,000 to 80,000 bbl. daily during February.

In a telegram to its Mississippi suppliers, Esso Standard said, "We regret having to take this action and ask your cooperation during this period of long supply."

PROCESSING BRIEFS ...

A carbon-black plant is scheduled for construction in the Toronto area by Columbian Carbon Co. The factory, to be operated by Columbian Carbon (Canada), Ltd., is expected to begin operations in 1961 with an initial annual capacity of approximately 40 million pounds.

AviSun Corp., a joint venture of Sun Oil Co. and American Viscose, will build a multimillion-dollar polypropylene plant that will have a capacity of 100 million pounds annually. The site, somewhere in the East, has not been selected. The construction contract has been awarded to Bechtel Corp., San Francisco.

A $2,000,000 expansion of ammonia, urea, nitric acid, and nitrate facilities at the Solar Nitrogen Chemicals, Lima, Ohio, plant is expected to be completed this year. The expansion will increase ammonia production 25,000 tons per year. The company is jointly owned by Atlas Powder Co. and Standard Oil Co. (Ohio).

A series of explosions ripped Lone Star Gas Co.'s Springtown, Tex., natural-gasoline plant February 25 causing heavy damage to the plant but no deaths or injuries. The plant, about 20 miles northwest of Fort Worth, has a capacity of 125,000,000 cu. ft. daily and a throughput in recent months of about 90,000,000 cu. ft. daily. Lone Star blames the explosion and fire on lines broken when a cooling tower collapsed under a heavy load of ice. The plant is expected to be out of action for some time. Lone Star's gas-transmission operations, however, have not been disrupted.

Also for Refiners ...

IN THE NEWS: Engineers working on auto afterburner have come up with a device that will measure hydrocarbon content of gases (p. 59) . . . In first decisions, imports board denies five appeals for quota relief (p. 60) . . . Companies are giving compact cars a try in their fleets in effort to cut operating costs (p. 62).

PLUS THESE TECHNICAL REPORTS: Refinery cost indexes (p. 91) . . . How feed boiling range affects cat cracker operation (p. 98).

Only a paint brush and solvent cement are needed to join Butyrate pipe.

Thanks to its light weight, pipe of Tenite Butyrate is easy to handle.

Pipe of Tenite Butyrate plastic means less downtime

As any oilman knows, metal flow lines carrying high paraffin crudes can completely plug in a very short time. Result: costly maintenance plus the loss of valuable production time.

Nearly ten years ago, some enterprising oilmen decided to do something about this problem and began to use pipe of Tenite Butyrate plastic for their operations. The inner wall of this pipe has an extra-smooth surface that discourages the accumulation of paraffin.

Since then, millions of feet of Butyrate plastic pipe have been installed by the petroleum industry. Users report many benefits.

Here's pipe that resists paraffin plugging

Butyrate pipe is virtually non-corrodible. It withstands the attack of sour crudes, salt water, and alkali soils.

Butyrate pipe gives greater flow volume. Smooth walls mean less load on pumps.

Butyrate pipe is tough. It can take rough handling and all normal backfilling operations.

Butyrate pipe is light. A 20' length of 4" pipe weighs only 20 lbs.

Butyrate pipe is easily joined. You just solvent-weld slip-sleeve couplings to the pipe ends. Any cutting can be done with an ordinary hand saw.

Couldn't this pipe be of help to you, as it has been to other oilmen for nearly a decade? Write us for additional information and the names of companies that produce the pipe and a complete range of fittings. Address: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

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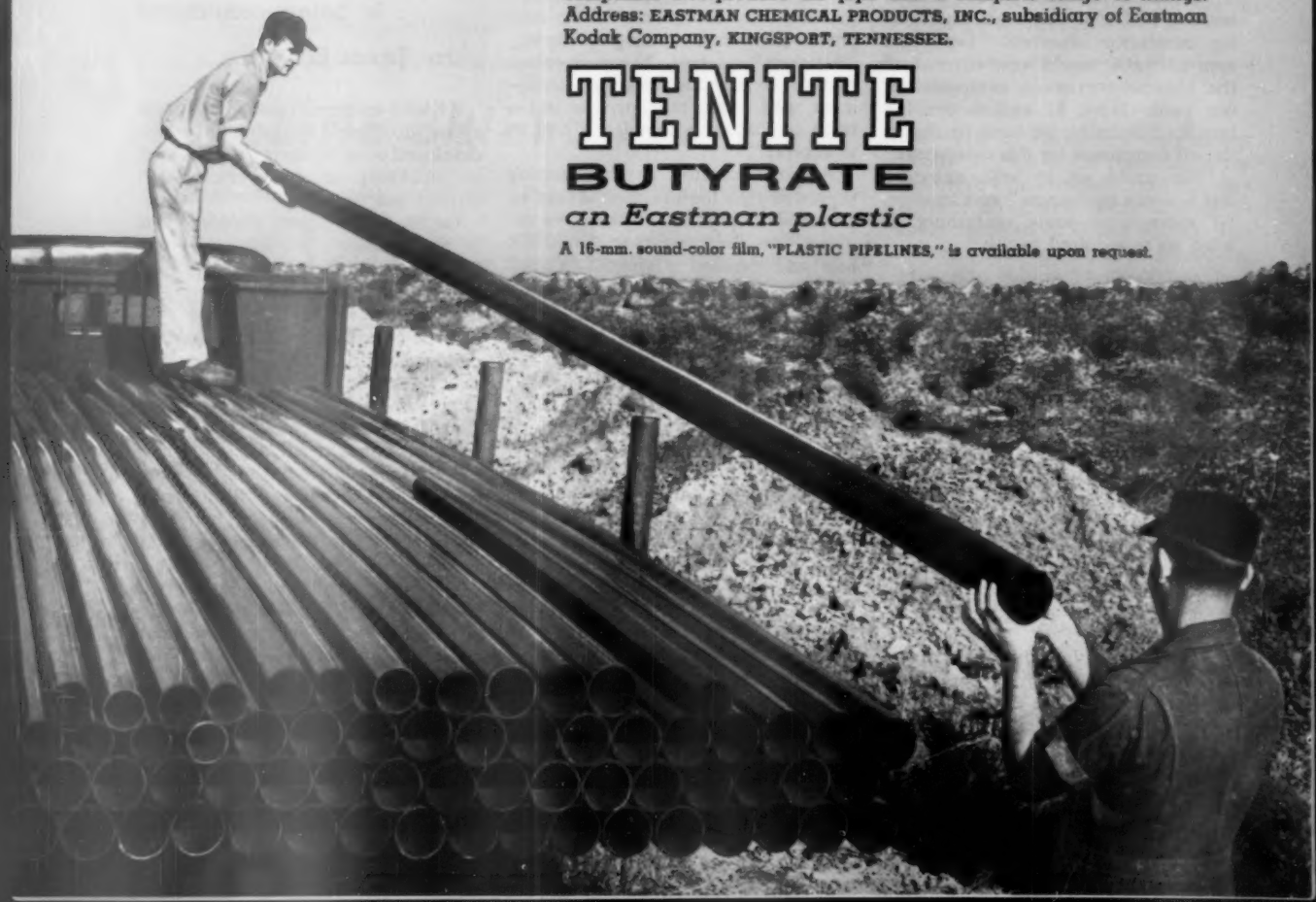


API Moves to Standardize Blowout Preventers

• Everybody now has his own specifications. But if the industry agrees on some standard designs for well-head hookups, it can save a lot of money.

"EVERYBODY agrees it's a great idea, but no one is willing to do anything about it."

This sums up the reaction of the men who have been trying for almost 3 years to find blowout-preventer hookups on which the oil industry can standardize.

Several of the major companies say they realize how much money they could save if there were good standards. And, each one says he will be glad to standardize if everyone else will settle for the particular hookup "I am using," observes one veteran of the standardization effort.

The man relating this uncompromising attitude is a member of the API Division of Production's southwestern district study committee on blowout-preventer installations.

His group is only one of several working on what most everyone agrees is a fertile area for cutting the cost of drilling wells. The API also has a national committee working on the project, as does the American Association of Oilwell Drilling Contractors.

At the API's southwestern district meeting in Dallas last week, one drilling contractor observed: "Ten years ago, $250,000 would have covered all the blowout-prevention equipment in our yard. Now, $1 million couldn't buy it. Naturally, we have to charge the oil companies for this equipment."

"We could get by with one-third less blowout equipment," says another, "if there were some uniformity in what we're required to use."

Little differences . . . To a casual listener at last week's committee meeting, the differences which prevented standardization appeared small:

"Should the choke line be 3-in. or 4-in.? Is it permissible to use blowout preventers with ports below the rams?"

Most admitted that these differences are small compared to the major issues such as pressure-rating of preventers, type and position of preventers, and general piping arrangement.

Yet, some companies appear to hold as tenaciously to their own peculiar hookup as if it were a recipe for everlasting youth.

"One company we drill for demands a 6-in. choke line," says a West Texas contractor. "No one else in the oil patch uses such a big line. And, no one in this company can explain why they have to have it. Somewhere back down the line, somebody put a 6-in. dimension on a drawing and it's been that way ever since."

"We have four different hookups," said another contractor. "We need a different one for each one of the four companies for which we do most of our work. A couple of weeks ago, I had to send two trucks to Oklahoma to pick up a hookup for this one company. The equipment we had in our yard wouldn't do, and it was cheaper to send the trucks than it was to rig up something new."

"A lot of our contracts state that the contractor shall provide adequate hydraulic blowout-prevention equipment without saying what 'adequate' is," stated one contractor.

"A lot of times we've set up our substructure and cemented the surface pipe before the operator tells us our preventer hookup isn't adequate. He wants us to install an annular-type preventer on top of those we've already got. And, most of the time, there simply isn't room for it under the floor."

The contractor admitted he usually found a way to squeeze in the new preventers without jacking up the rig. "But then," he says, "when it comes time to pay for this extra time, equipment, and work, the operator has a blind spot about how much it cost us to comply."

A noncontractor at the meeting suggested that the operator should be prepared to pay for anything he ordered, that the contractor should bill him and demand payment. "Yeah," was the contractor's rejoinder," and a fat chance we'd have of ever getting another contract from that company."

Some progress . . . Thus far, the API study committee has come forward with four hookups which it suggests as worthy standards in mud drilling.

One hookup is for 5,000-psi. working pressure; others are for 3,000 psi., 2,000 psi., and an alternate 3,000 psi.

Another four hookups are being recommended for air and gas drilling. These are substantially different from those for mud drilling because they include spools for air-return lines, rotating head, and the like.

Heaviest of the air-gas drilling hookups is a stack for 5,000-psi. working pressure. It includes choke spool, double-ram type preventer, single-ram type preventer, blowline spool, annular-type preventer, and rotating head.

"Use of this hookup requires a 22-ft. substructure," commented one of the would-be standardizers.

The hookup also includes 4-in. plus 6-in. hydraulically operated valves. "The manufacturers don't give those valves away," was one contractor's understatement. "If the next job we get calls for a different size or pressure rating, we have to tie up several thousand dollars more in their equipment, perhaps for only one or two wells."

With so much money to gain and only time to be spent, the committee prepared last week to send out drawings of its long-debated suggestions for standard hookups to operating oil companies and drilling contractors.

"Let's hope," said the chairman, "that our letters get to the right people to get some results."

Pipelining of Coal

. . . is being considered by Texas Eastern.

TEXAS Eastern Transmission Corp. expects to expand its operations in undeveloped areas of energy supply, such as pipelining of coal, stockholders learned last week.

Orville S. Carpenter, president, said in his company's annual report that Texas Eastern last year moved into "the broad field of energy supply on a much greater scale."

In addition to expanding natural gas and petroleum products pipeline systems, Texas Eastern is searching actively for gas and oil and is negotiating a deal to pipeline coal from West Virginia to eastern utilities.

"The company is constantly exploring for possible ways of broadening its earnings base through increasing participation in the whole field of energy supply," Carpenter said.

Texas Eastern is negotiating with Consolidation Coal Co. and with potential customers on the East Coast to build a line that will take coal in a slurry for a distance of some 350 miles. The size of the line and the tonnage to be run will depend on the demand which Texas Eastern finds during negotiations.

Offshore Secondary Recovery Paying Off

THE FIRST sizable pressure-maintenance project in the Gulf of Mexico is approaching its first birthday, and its operators, for the moment, are satisfied with the results.

The project is just barely in the Gulf—under the Southwest Pass main arm of the Mississippi River in the Block 24 field, South Pass area.

The California Co. says its water-injection program has succeeded in halting an alarming drop in reservoir pressure and actually started it upward. However, the project is too young to be called an unqualified success.

An area covered by 39 producing wells is affected by the program.

When the Block 24 field was discovered in 1953, pressure was 4,077 psi., and when the field was at its peak in 1955, the 39 wells were producing about 9,000 bbl. daily. By 1959, pressure had dropped to 2,340 psi., and production was down to 3,500 bbl. daily. Part of the production drop, however, was due to economic factors, such as lower allowables.

Today the pressure has been stabilized at 2,370 psi., and production is just under 5,000 bbl. daily. Calco said its main purpose was to stop the pressure decline, and that's what has occurred.

The operators drilled one injection well and are injecting 9,000 bbl. of water daily below the oil-water contact on the east flank of the pool. The producing wells are taking out about the same amount of water. If the water production increases, Calco may drill a second injection well.

"We want to inject at least as much as we take out," an engineer on the project said, "but the 9,000 bbl. apparently is satisfactory today."

The project is notable for the Gulf Coast because most fields have an abundant natural water drive. But the 8,200-ft. "T" sand Horstal unit pool is sealed off from an aquifer by heavy faulting, and a pressure-maintenance program became imperative.

The "T" sand has produced 12,500,000 bbl. of crude to date, and Calco expects to increase its ultimate recovery of crude in the reservoir by 50% with its pressure-maintenance project.

Ownership of the unit is divided among Calco, with 59.3%, Shell Oil Co., 38.1%, and the CATC group, 2.6%.

Shell may inject . . . The project is not the only pressure maintenance or water flood program in the Gulf, but it is the only one of considerable size.

Shell recently applied for permission to start a smaller injection project in the same field. Shell plans to inject water through one of three producing wells. Later two other shut-in wells will be placed on production if the program is successful.

The "T1" sand involved in the Shell project occurs at the 9,564-9,614 interval.

The Louisiana Conservation Department has set a hearing for March 11 on the application.

Next week

New pipeline map

NEXT WEEK, the Journal will feature a special report on natural gas and natural-gas pipelines.

This will include a new 3-by-4-ft. wall map showing existing and proposed natural-gas lines with compressor-station locations in the U. S. and Canada.

The special 39-page report will bring you the latest in new construction techniques, cost reductions, and the future of domestic natural-gas reserves.

Watch for this important Journal special March 14.

PIPELINE BRIEFS . . .

Construction is getting under way on 120 miles of 10, 12, 16, and 20-in. gas line between Portland and Eugene, Ore., for El Paso Natural. The contract was awarded to Hood Construction Co. and River Construction Corp. The extension line will take gas from El Paso's main line for delivery to Northwest Natural Gas. Project headquarters will be at Camas, Wash., and Oregon City, Ore.

A 125-mile gas line from Pincher Creek field in southern Alberta to the British American refinery at Calgary, is planned this year. British American has placed the project before the Alberta Public Utilities Board for approval and expects to ask for bids soon. Pincher Creek is already connected to the Trans-Canada system through a 24-in. lateral of Alberta Gas Trunk Line Co.

Some 95 miles of gas trunk line and 34 miles of gathering line are planned this year by Manufacturers Light & Heat Co. Bids are due March 15 on 66 miles of 20-in. from Abbotstown to the Fulton-Franklin County line in Pennsylvania.

A 29-mile 36-in. line will be constructed during 1960-62 by Peoples Gas Light & Coke Co. between its North Shore and Calumet stations in the Chicago area. The first phase of the project will be 8 miles costing $6,000,000 on the north end.

The largest compressor station in the world in connection with underground storage is the claim made for Michigan Consolidated Gas Co.'s 40,000-hp. Six Lakes, Mich., station 50 miles northeast of Grand Rapids. The company has completed a 20,000-hp. expansion costing $4,800,000. A new 30-in. line and two 24-in. lines connect Detroit with Six Lakes, once Michigan's largest gas field in which 67 billion cubic feet of gas is stored for winter demand.

A 35-mile 18-in. gas line will be built by Houston Pipe Line Co. from Sheridan to Wharton, Tex., in the Houston area. Bids were received last week.

Also for Pipeliners . . .

IN THE NEWS: FPC is trying pretrial conference technique to speed up the disposition of natural-gas cases (p. 57) . . . FPC increases interest producer or pipeline must pay if it has to make a rate refund (p. 58) . . . Soviets are shopping for line pipe to build a crude system to the satellites (p. 83).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are covered in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Full automatic control for pipelines (p. 94) . . . Kuwait terminal to switch to remote operation (p. 125).

Japs Get Assured Market for New Oil

• Refiners in Japan will be forced to take crude from new Persian Gulf field due to Japan's dollar-allocation system on imports. And Arabian Oil is moving fast to get this new oil on the market.

ARABIAN OIL CO., Japanese-owned firm with a new Persian Gulf offshore discovery, plans to anchor T-2 tankers alongside wellheads 25 miles off the Neutral Zone in order to begin moving oil as quickly as possible.

Japan Petroleum Trading Co., parent of the successful exploration company, has four T-2's lined up for use as temporary storage until more conventional tanks can be built ashore.

Last week as the company started drilling its second well, it moved into high gear to wedge its Middle East production into a rapidly growing Japanese market. Here are the new developments:

... A new oil-storage company was formed at the Tokyo end of the Persian Gulf-Japan axis to handle the company's crude just as soon as it can be moved to Japan. The new company, Yokkaichi Yuso, will be owned 60% by Daiko Oil Co. and 40% by Japan Petroleum Trading.

... Two 46,000-ton tankers to move Persian Gulf Japanese production to the home islands have already been ordered by the parent firm. One is to be built by Mitsubishi Shipbuilding Co. and is slated for completion in March 1962. The other will be built by Mitsubishi Heavy Industries Co. and will be delivered in June 1962. The company already has a 41,300-ton tanker, the Riyadh Maru, under a 5-year contract hauling Middle East crude to Maruzen Oil Co. in Japan.

... Japanese refiners, including those with major oil company interests, concede they will buy Arabian Oil's crude output even if they can buy other Middle East oil at a more advantageous price.

... This assured market will exist as long as the Japanese Government maintains its dollar allocation system for imports. Because the country is basically dollar-short in foreign exchange and because more than 10% of its imports are in crude oil for Japanese refineries, the allocation system is here to stay.

The one currency advantage of Arabian Oil Co. crude over other Middle East crude sources is that the Japanese company's output can be bought with at least 50% of payment in yen.

The discovery . . . The Japanese company, which traded the traditional 50-50 concept of a profit division in the Middle East for its offshore concession, found production in its first well after a near disastrous blowout (OGJ, Feb. 8, p. 74; Feb. 15, p. 82; and Feb. 22, p. 85).

Officials of Arabian Oil Co. last week avoided talking definite figures on the thickness of pay in the first well, but well-founded industry rumor put the total pay thickness at 700 ft. with a net effective pay of 500 ft. of sand.

The well entered the Upper Burgan sand at about 4,820 ft. and the Lower Burgan at 5,200 ft. The test, originally slated to go to 8,000 ft., was completed at 5,476 ft.

The Japanese say they plan to complete development wells with a larger choke than the ¾-in. choke which limits the discovery to a little more than 6,000 bbl. daily. Even this is regarded as a conservative figure.

Concession terms . . . The Japanese themselves are placing a slightly different emphasis on the terms they granted both Kuwait and Saudi Arabia than has the industry generally since the contract was made.

The Japanese agreed to a 56-44 profit split with Saudi Arabia and a 57-43 division with Kuwait, along with provisions for the two owner countries to share in transportation, refining, and marketing profits. The Japanese say this profit split on moving the oil, refining it, and selling it becomes a factor only when they themselves begin to refine and market.

According to the Saudi contract, the Japanese shall commence as rapidly as reasonably practicable to build a refinery in Saudi Arabia when production has averaged 30,000 bbl. daily for a period of 90 days.

When production reaches 75,000 bbl. daily for a 3-month period, the Japanese company is required to commence a refinery that will process not less than 30% of the production.

The Kuwaiti contract is slightly different. When production reaches 30,000 bbl. daily the company is required to discuss with the Shaikh building a "suitable" refinery in Kuwait. Only when production reaches 75,000 bbl. daily, is the company required to begin building a refinery.

On the basis of the first well alone, it is apparent that the Japanese must begin thinking in terms of a refinery almost immediately. It is unlikely that they will think in terms of the kind of a refinery required by the Saudi contract when a reasonable amount of development drilling would mean almost immediate expansion of a basic plant in order to meet the terms of the agreement.

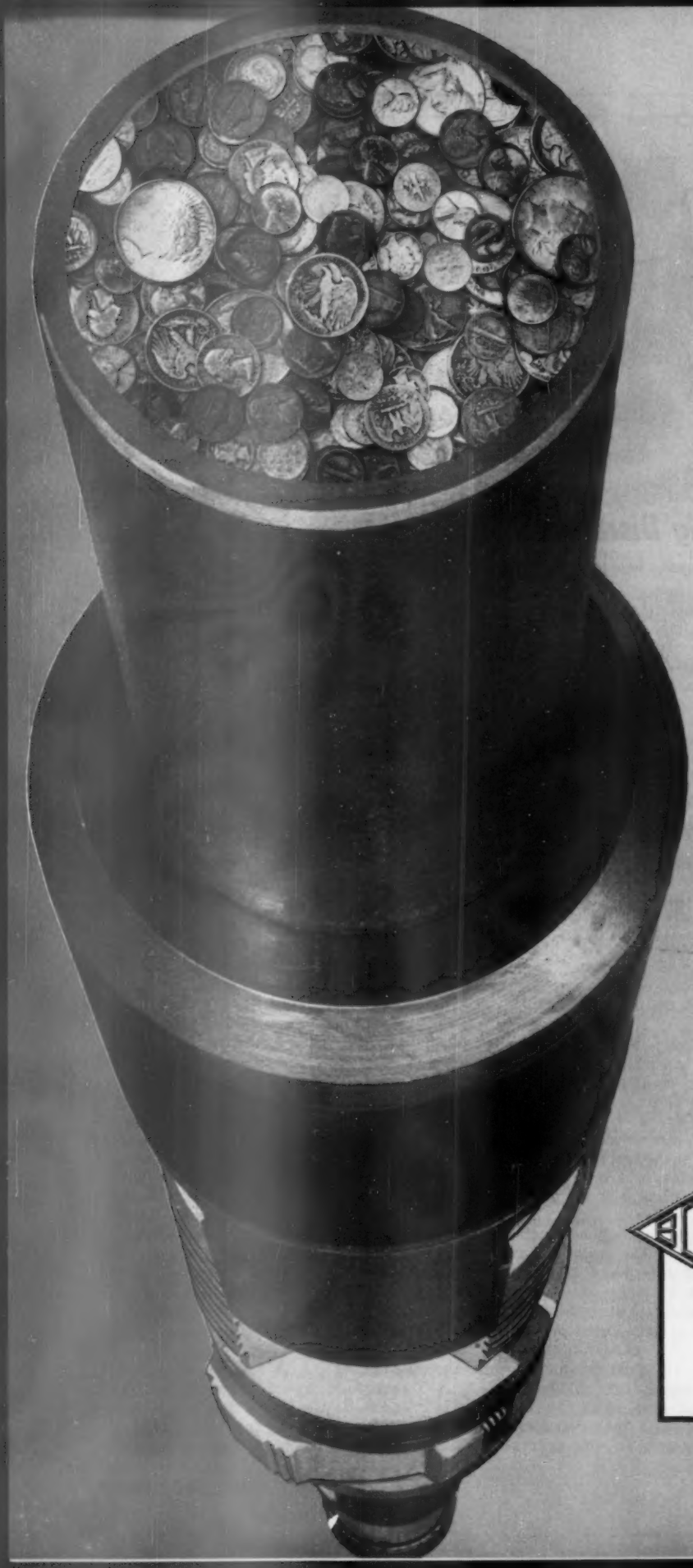
Taro Yamashita, president of the Japanese company, met last week in Cairo with Sheikh Abdullah Tariki, director of Saudi Arabian oil affairs. Tokyo says negotiation on the refinery size is essential if the company is to make the most economical investment possible.

Currency saving . . . The Japanese expect to see a real hard-currency saving in the operation of producing and selling "yen oil" in Japan.

The concession contracts with both Saudi Arabia and Kuwait call for payment to both countries in "U. S. dollars," but the Japanese expect their major investments and operating costs to be paid in yen.

Since the Japanese are now paying almost 100% for imported oil in dollars, they can save from 43 to 44% of the dollar cost of oil with every barrel of crude that is moved into Japan from the new producing operation.

In addition, any dollar crude or products sales, once the Middle East refining operations get under way, will serve only to bolster the Japanese hard-currency position further.



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Use Cam-Lok as a packer during the flowing life of your well. When the well goes on the pump, convert Cam-Lok to a tubing anchor while you are working over the well and run it back. Thrifty? You bet it is!

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Cam-Lok is a tough, compact, full-opening, retrievable, reliable tool. In its simplest application, Cam-Lok is used as a weight set packer. Cam-Lok is set in tension to take advantage of pressure from below when testing, water flooding, fracturing, acidizing, or in shallow wells where the tubing weight and casing fluid column may not be sufficient to hold the packer weight-set against high bottom hole pressure.

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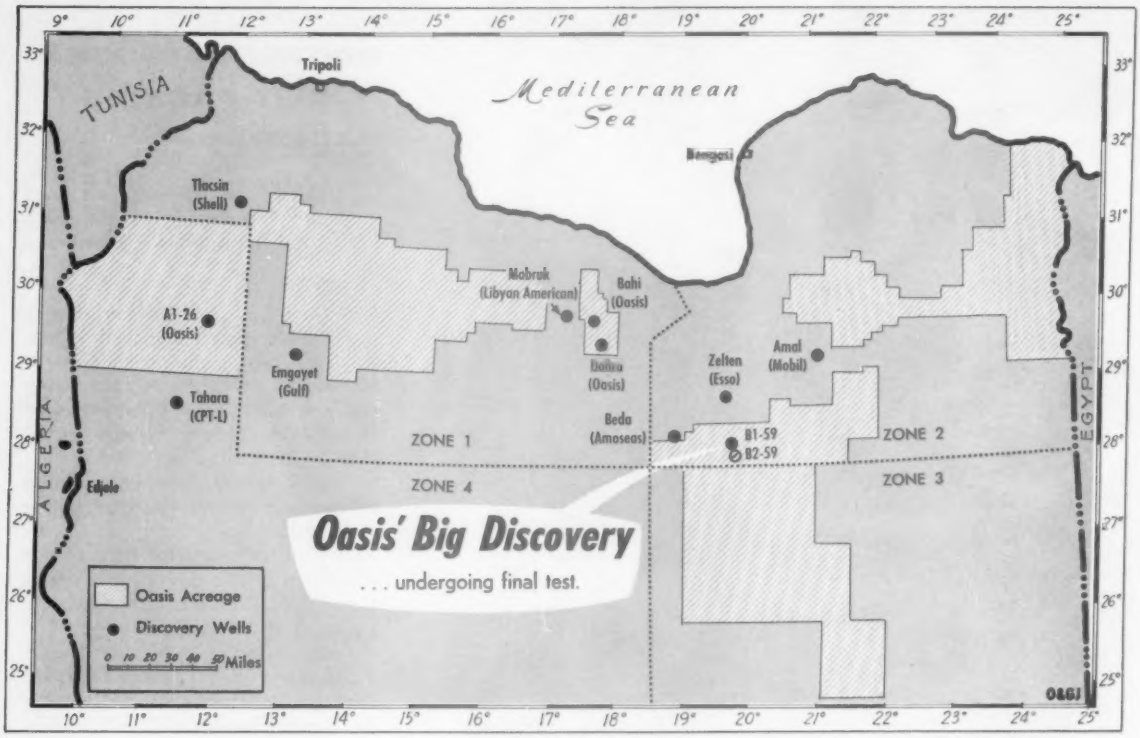

Another Major Find Made in Libya

• Oasis is tight lipped about just how much its B1-59 well will make, but a spokesman concedes it may be company's best well in Libya. The discovery is south of Esso's Zelten field and on a big block under lease to Oasis.

OASIS OIL CO., Libya's most active wildcatter, is about ready to add another major oil field to the country's rapidly growing roster of successes.

The new discovery, B1-59, is still undergoing extensive tests, but there is every indication it is a major find.

Oasis will not discuss test results until testing is complete. Industry observers in Libya do not believe some of the rumored test figures are indicative of the wells potential. They rank the new discovery closely behind Esso Standard's big Zelten field as the second best found to date in Libya.

Oasis, wholly owned subsidiary of the Ohio Oil Co., is operator in Libya for the Ohio - Continental - Amerada group. In this capacity Oasis easily controls the largest total acreage under concession in the country. The company has 10 active rigs in Libya in an intensive effort to evaluate as much of the acreage held by the three companies as possible before parts of it have to be turned back to the government.

Last week the rig which drilled B1-59 spudded a 4-mile stepout to the south and east. A service rig continued to test the discovery hole.

How big is well . . . Industry speculation labeled the well as major discovery as long as 30 days ago.

An Oasis spokesman conceded last week that B1-59 is a "very significant well" and voiced the opinion that it may be the best well yet drilled by the company in Libya. This would certainly place it in the major discovery class.

Oasis has 7 other producers in the country. The most startling completed so far was F-2 in the company's Block 32 where its Bahi and Dahra fields are located. F-2 was a 3-mile stepout from Dahra and tested 2,800 bbl. daily of 43°-crude on its first tests. On final production tests the well made 8,000 bbl. daily.

The new Block 59 discovery is about 170 miles southeast of the Dahra area. It is the third well drilled on the block by Oasis. The first, A1-59, drilled about 25 miles to the north was abandoned at 7,262 ft. as a dry hole last October. The second dry hole C1, was almost 60 miles to the west and located just south of the Caltex Beda find which tested more than 3,600 bbl. daily.

If Oasis has found a sizable structure in the B1-59, the company has ample room to explore it without rubbing elbows with a competing company holding the adjoining block. The well is at the southern edge of Block 59, which contains more than 9,400 sq. miles. The company also has another 13,000 sq. miles of acreage to the South in Block 71.

The discovery is about 60 miles south and just slightly east of Esso's big Zelten field development.

Zelten . . . Esso was preparing last week to complete the fifth well in Zelten field north of the new Oasis activity.

Zelten 5 has tested from 40 to 100

bbl. an hour in a whole series of drill-stem tests of several productive zones. The well was drilled to a total depth of 5,913 ft., then plugged back up the hole from the water table encountered at 5,340 ft.

Location for Zelten 6 had not been decided. It may be drilled about 3.5 miles west of No. 5 or the company may make No. 6 an infill well between the discovery and No. 4 to determine if their structure is faulted.

After the discovery tested 17,500 bbl. daily and the second well was good for 15,000 bbl. daily, Esso found the Paleocene pay disappointingly dry in No. 3. The third well was deepened and found a new crystalline limestone at 7,615 ft. which tested about 100 bbl. an hour.

The structurally much lower pay found in No. 3 may indicate a deeper Cretaceous pay or that the well is in a fault block. It will take some infill drilling to answer the puzzle.

Lacq Plans Revised

. . . with less gas going to customers in Paris area.

LACQ, the big gas field in southwestern France, is one of the world's largest, but its reserves will not stretch as far as the country had hoped.

Gaz de France, which has built a 550-mile 24-in. and 20-in. line to Paris, has cancelled some of its contracts with industries in the Paris area.

The government-owned company says that increased needs by customers near the field and a high production rate in proportion to reserves has forced it to pull in its horns. Another factor is a lack of a market for sulfur stripped from the gas.

Some of the customers involved are charging government is motivated by a desire to have industries move from the Paris area to southwestern France.

The Lacq area is rapidly becoming one of Europe's major petrochemical centers. Five companies have been formed within the last 2 years to produce chemicals based on gas from the field.

The latest of these is Vinylacq, organized by Pechiney, St. Gobain, and Banque de Paris et Des Pays-Bas. It will produce chlorure of vinyl from acetylene feed supplied by another new company, Aquitaine-Chimie.

In addition to the gas alloted to the pipeline system and supplies needed by the petrochemical industry, another 155 million cubic feet daily is earmarked for the production of electricity, which will be used to manufacture aluminum in the Lacq area.

ENI Plan Draws Fire

. . . from big international companies. Shell, Jersey, and Mobil step up plans for refineries in Bavaria as result of ENI's proposal to move into the area.

ITALY'S aggressive Enrico Mattei, no stranger to feuds with oil companies, probably expected a fight when he looked northward across the Alps last year and announced he was taking over a big slice of the rich Bavarian market. He is now getting it.

The coming struggle may be the severest test of Mattei in his new 3-year term as head of the Italian Government's national oil company. The outcome may go a long way in determining how far he can go in pushing his organization into the status of a government-run international major.

Mattei stirred up a hornets nest by revealing plans for a crude-oil pipeline system from Genoa to southern Germany, via Switzerland. In addition to two refineries in Italy, the system would feed a plant at Aigle, Switzerland, and two in southern Germany, where ENI has no marketing organization.

Three companies have reacted by deciding to build refineries of their own in Bavaria. They are local affiliates of Royal Dutch-Shell, Jersey Standard, and the Gelsenberg-Mobil Oil group. A fourth company, British Petroleum, is studying the possibility.

A knock-down, drag-out gasoline price war is waging over most parts of Germany, and marketers stand to lose $40 million this year from recent price cuts if they stay in effect. Bavaria has been the last region to be hit by this competition.

Majors fear, however, that Mattei's 560-mile system will require a high throughput to pay off. They believe he may need subsidization from local governments, and in turn might obtain a monopoly at the expense of local marketers.

The prize . . . Bavaria's 9-million people use 70,000 bbl. daily of products, a level of consumption that will grow to 110,000 bbl. daily by 1965.

Most of the products are brought in 435 miles by rail from Hamburg. But oil is now barged on the Rhine River from new refineries in the Ruhr and Rotterdam areas. Some oil also is imported from Eastern Europe, coming in via the Danube.

Propose pipelines . . . Companies have two possible locations for refineries. One is the Munich area, where consumption is centered. The other is Regensburg, which is nearer the geographic center of the state, and which lies on the Danube.

In addition to existing marketing organizations, companies have a good hole card since they will be able to use a common-carrier pipeline, enabling them to maintain a higher throughput at lower per barrel cost of transportation. Studies are under way on two possible routes.

The shortest of these from tidewater is a 220 to 250 mile route from Venice to Munich via Austria. Drawbacks to this proposal are that the line would pass through very mountainous terrain, and that harbor improvements would be required at Venice.

An alternative route would be an extension of the 459-mile, big-inch crude line from Marseille to Karlsruhe, West Germany. The system is definitely planned, and it will have plenty of spare capacity for a 170-mile extension into the Munich or Regensburg area.

Mattei progress . . . Mattei has run into trouble securing necessary permits for his project, both in Switzerland and Germany. But he says ditching work is under way on the section from Genoa to Milan, and that he will start building a network of service stations in southern Germany.

The ENI proposal is backed by German and other bankers. Sudpetrol A.G., founded to carry out the project, is half owned by Germany bankers, and half by ENI and Italo-Suisse.

Stanvac Quits Somaliland

STANDARD-VACUUM is giving up an 11,000-sq.-mile concession in British Somaliland after a discouraging 6-year exploration program.

The company's decision came after abandoning its fourth wildcat in the East African protectorate, bordering the Gulf of Aden. The well, Biyo Dader 1, was given up at 4,850 ft. Three earlier dry holes at Dagah Shabel were drilled to the same depth range.

Stanvac is the second company to withdraw from the country. The Conorada group pulled out late in 1958 after drilling five dry holes. The only remaining area under license is a strip along the northwest coast held by British Petroleum Co.

Production Record Set

- **U. S. increase pushes free-world crude output over 17 million barrels daily for first time.**

FREE-WORLD crude production passed the 17-million-barrel-daily level for the first time in December.

The year-end record was the result of a 211,000-bbl.-daily increase in the United States. Foreign production dipped from the all-time high of the previous month. But it still was the second highest in history. Gains in Venezuela, Canada, and some of the smaller producing countries offset lower production in the Middle East.

Big-scale production in the French Sahara got off to a flying start during the first month of operation of the Hassi Messaoud pipeline to the Mediterranean. Output from the giant young oil field rose to 93,200 bbl. daily.

Argentina also ended the year on a high note when output reached a record 135,900 bbl. daily. Another peak was reached in Colombia, where output hit 153,400 bbl. daily.

TREND OVER THE LAST YEAR

	Western Hemisphere less U.S.	Middle East	Total free-world outside U.S.
1958			
December	4,120.2	4,446.2	9,383.0
1959			
January	4,311.6	4,369.3	9,449.5
February	4,453.9	4,426.1	9,649.7
March	4,220.6	4,634.2	9,680.7
April	3,910.4	4,646.4	9,396.5
May	3,773.6	4,571.4	9,181.0
June	4,111.5	4,467.9	9,428.7
July	3,914.8	4,532.5	9,293.2
August	3,862.1	4,659.7	9,344.9
September	3,887.5	4,635.5	9,396.4
October	4,069.6	4,688.2	9,629.8
November	4,123.2	4,820.7	9,877.9
December	4,217.8	4,682.3	9,853.6

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	Dec. 1959	Nov. 1959	Dec. 1958
Western Hemisphere			
Argentina	135.9	128.2	111.7
Bolivia	9.1	9.0	9.1
Brazil	75.0	75.0	62.3
Canada	527.3	477.5	503.3
Chile	18.8	18.8	16.0
Colombia	153.4	144.3	135.2
Cuba	0.6	0.5	0.5
Ecuador	7.1	7.3	8.1
Mexico	265.0	265.0	265.6
Peru	47.2	47.2	49.8
Trinidad	115.8	115.8	110.1
Venezuela	2,862.6	2,834.6	2,848.5
Total	4,217.8	4,123.2	4,120.2
Europe			
Austria	45.3	45.3	51.1
France	36.4	34.7	28.6
West Germany	101.8	104.5	91.8
Italy	37.3	35.8	33.6
Netherlands	33.7	34.1	34.6
United Kingdom	1.7	1.7	1.7
Yugoslavia	12.4	12.4	8.6
Total	268.6	268.5	250.0
Middle East			
Bahrain	45.0	45.2	45.2
Iran*	939.0	995.0	827.0
Iraq†	901.5	907.8	798.0
Israel	2.0	2.0	2.0
Kuwait	1,302.5	1,370.1	1,442.7
Neutral Zone	122.0	122.0	106.2
Qatar	153.5	161.1	184.0
Saudi Arabia	1,209.6	1,210.3	1,034.6
Turkey	7.2	7.2	6.5
Total	4,682.3	4,820.7	4,446.2

Country—	Dec. 1959	Nov. 1959	Dec. 1958
Other Asia			
British Borneo	110.0	110.0	106.9
Burma	10.5	10.5	10.3
India	8.5	8.5	8.5
Indonesia	350.0	360.0	332.3
Japan	8.7	8.7	7.3
New Guinea	4.5	4.5	5.1
Pakistan	5.9	5.9	6.0
Total	498.1	508.1	476.4
Africa			
Algeria	93.2	64.3	11.3
Angola	0.9	0.9	0.8
Egypt	61.4	61.6	58.9
Gabon	14.1	14.4	11.3
Morocco	2.2	2.2	1.3
Nigeria	15.0	14.0	6.6
Total	186.8	157.4	90.2
Free World			
Foreign	9,853.6	9,877.9	9,383.0
United States	7,193.0	6,982.0	6,911.0
Total	17,046.6	16,859.9	16,294.0
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	235.0
Russia	2,688.0	2,688.0	2,260.0
Others	100.0	100.0	60.0
Total	3,023.0	3,023.0	2,555.0
WORLD TOTAL	**20,069.6**	**19,882.9**	**18,849.0**

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 6,000 bbl. daily from Naft-i-Shah field not operated by Consortium companies. †Includes estimated 3,300 bbl. daily from Naft Khaneh field, operated by Iraq Government.

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Iran Has High Hopes for Next 5 Years

● NIOC chairman outlines energetic program for his company, and also says he expects consortium companies to increase production.

IRAN has some ambitious oil aims for the next 5 years. Some of them could add to the troubles of a world already oversupplied with oil.

Some of the goals, Iranians themselves expect to meet. Others the Iranians want the international consortium of companies operating the country's primary producing fields and its big refinery to meet.

Abdollah Entezam, chairman of the government - owned National Iranian Oil Co., outlined the 5-year goals in a recent speech in Teheran. Most of the time he talked about the ambitions of his own Iranian company and its plans to supply internal oil needs of Iran.

But, he tossed several hot potatoes toward management of the consortium, and when he did, he wasn't talking in terms of holding down production to preserve oil prices like many of his Arab neighbors in the Middle East are doing these days.

"The increase of exportation of Iranian crude oil and oil products is one of the points to which special consideration has been given," Entezam said. "NIOC will spare no effort in carrying out this purpose . . ."

"NIOC will insist that the rate of oil exportation by the trading companies be raised to an extent proportional to the oil reserves in the area of the consortium's operations."

Neither Iran nor the consortium talks officially about proved reserves in the country, but The Oil and Gas Journal estimates Iran's reserves at 35 billion barrels.

In January, the consortium's operating company produced an average of 993,000 bbl. daily, slightly under the country's recent peak of more than 1 million barrels daily.

This potential will be boosted by more than 300,000 bbl. daily with the completion of the Gach Saran-Kharg Island pipeline system and the full operation of the island's new loading terminal.

NIOC's own aims . . . Entezam pointed out that all current estimates indicate domestic Iranian consumption of oil products will increase from today's 60,000 bbl. daily to at least 100,000 bbl. daily by 1964.

Here are his basic aims:

. . . Meeting internal consumption needs with oil products of the best quality at lowest prices.

He estimated NIOC will have to spend $121.5 million during the 5-year period for distribution equipment, but he says the investment can be amortized within 10 years and future capital required in distribution be met from revenues.

. . . A new refinery at Teheran with at least 40,000 bbl. capacity within the next 5 years.

Entezam is confident that this refinery can be operated on the liquid hydrocarbon production from Sarajeh and other fields in the Teheran vicinity which he thinks NIOC will discover and develop.

The NIOC chairman has estimated the gas reserves of Sarajeh at 7 trillion cubic feet and its condensate reserves at more than 400 million barrels, (OGJ, Feb. 29, p. 58).

Entezam says the heating value of Sarajeh's reserves equals more than 2 billion barrels of oil which would serve the entire fuel needs of Teheran as well as central and northern Iran "for many years to come."

He estimates that pipeline construction to take the gas to Teheran will cost $27 million, but revenues from the sale of the gas in 10 years will amount to $108 million. To this can be added an annual saving of the $15 million which the country now spends to move products north from Abadan.

He said NIOC has already spent $52 million building a products line linking Abadan and Teheran, but is saving $16 million a year in transport costs every year it is in use.

. . . Kermanshah refinery expansion and improvement.

In order to take more of the trans-

portation load from the pipeline system and the Abadan refinery, Entezam says the 5,000-bbl. Kermanshah refinery must be expanded and improved. He concedes that the distillation plant does not now produce light products of the same quality as Abadan and says this product improvement is a must.

... A petrochemicals industry must be formed to utilize wasted natural gas.

The NIOC chairman says that "millions of cubic meters" of natural gas are wasted "every day" in the Khusistan oil fields operated by the consortium. He points out that only 212,000 M.c.f. of this gas daily will produce 4,000 tons of plastics and 80,000 tons of chemical fertilizers a year.

... Continuing a drilling program in several parts of the country.

NIOC will concentrate much of its drilling activity on the Alborz structure and the nearby Sarajeh structure. The Iranians also are doing some work in the Gorgan area, which is near the southern tip of the Caspian Sea.

The established producing area at Naft-i-Shan will also get some attention under the plans outlined by Entezam.

Reds Shop for Line Pipe

. . . to build crude system to satellites. U. S. is out of the picture, but some European country may make deal.

ITALY may supply some of the pipe for a crude pipeline being built from Russia into eastern Europe.

Dalmine Steel Pipe and the government's ENI are negotiating a barter deal with Russia in which pipe for part of the 2,500-mile system would be exchanged for oil.

ENI had sought the role of prime contractor for the project. It now will probably be limited to handling the incoming crude if the deal goes through. The exception may be that one ENI affiliate, Nuova Pignone, may supply pumps, or other special equipment.

Two West German pipe manufacturers are also negotiating with Russia for a supply contract. The various companies involved had sought to set up a consortium arrangement, but Russia reportedly has turned thumbs down on this. One of the problems holding up an agreement is that Russia has not made up its mind on pipe specifications for parts of the line.

Russia has been shopping for pipe in Western Europe because of a lack of capacity in its own mills. It is experimenting with several types of substitute materials. These include asbestos cement for large diameter, and plywood, for small diameter lines. U. S. export restrictions prohibit the sale of big-inch pipe to Russia from this country.

The line will carry crude from fields in the Volga area to Poland, East Germany, Czechoslovakia, and Hungary. It is expected to deliver 300,000 bbl. daily, enough to supply the entire demand of the terminal countries. The system is scheduled for completion within 4 years.

Each country is supposed to build and pay for the section of pipe within its borders. Czechoslovakia has already started laying pipe westward from the Russian frontier (OGJ, Oct. 12, p. 106).

FOREIGN BRIEFS . . .

Construction contract for a $14-million 20,000-bbl. refinery in Morocco has been awarded to SNAM-Progetti, an affiliate of ENI, which will own the plant jointly with Moroccan interests. Work will start immediately at Mohammadia, 20 miles north of Casablanca. The plant is scheduled to go on stream in 1962.

Panoil Co., Dallas, has purchased 1,000,000 shares of Premier Consolidated Oilfields stock from Gruss & Co., New York. The purchase represents about 12½% of the stock of the British-based Premier, which is operating in Trinidad. Panoil is earning an option to purchase 1,200,000 shares of Premier treasury stock by giving Premier technical direction in its Trinidad operations.

Petrorep, the private French company developing Coulommes field in the Paris basin, has been awarded another concession north of Paris. The 1,025-sq.-mile license is in the Noyon area.

Local Lebanese marketers are asking the government to pressure Mediterranean Refining Co. to reserve 20% of its output for private distributors. The company is owned jointly by Mobil Oil and Caltex. Local firms already have 20% of the products from the country's other refinery, a 11,550-bbl. plant owned by Iraq Petroleum Co.

Cia. Shell de Venezuela has officially inaugurated its new Puerto Miranda terminal on Lake Maracaibo. The terminal can handle 440,000 bbl. daily from Shell's Bolivar, Boscan, and lake properties, and the basic design will permit expansion to nearly double the capacity later. Thirteen grades of crude can be taken care of at the same time (OGJ, Nov. 2, p. 92).

Prospecting licenses covering all of Jamaica and its territorial waters have been issued to Jamaica-Time Petroleum, Inc. The company is starting a 14 month exploration program.

Russia says it is testing the world's first cleaning and insulating machine for 40-in. pipe. The equipment will be used in laying an 800-mile 40-in. natural-gas line from Krasnodar fields, north of the Caucasus Mountains, to Moscow, and on a planned 1,300-mile 40-in. line from Gazli field to Bukhara and Chelyabinsk, east of the Ural Mountains.

Russia plans to drill a 22,965-ft. test at the eastern tip of Apsheron peninsula at Baku. The well will be the deepest ever drilled in the Eastern Hemisphere.

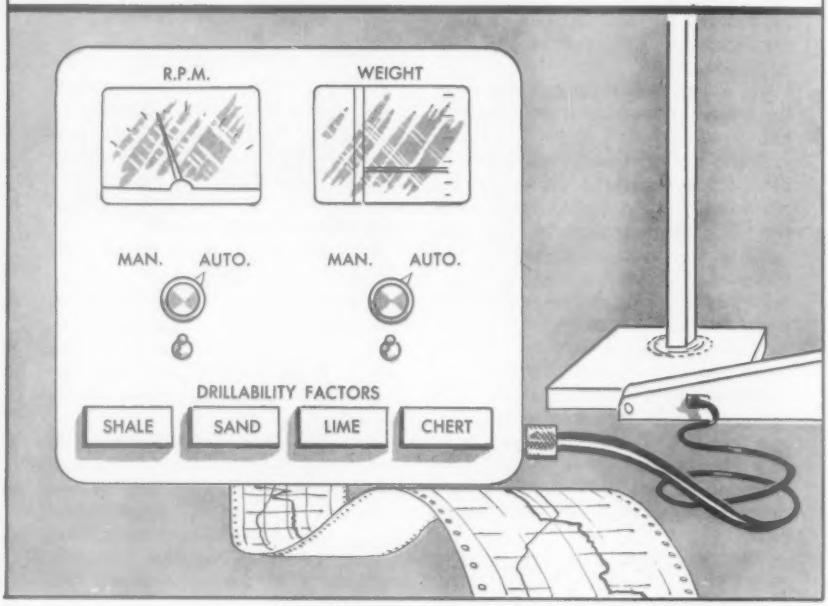
A preliminary survey of northeast Thailand will be carired out by Royal Dutch-Shell. If the results are hopeful, a full-scale survey will be started. The region is known as the Korat Plateau.

The first turbodrill to rig up in Libya is starting the A2 well in Block 23, operated by the French CPTL. Another French firm, FORENCO, will be the drilling contractor, using a NEYRFOR-type drill.

Iraq revenue from the oil industry rose more than 8% last year to $242 million. Exports of oil were up even more, with a gain of 17% to 800,000 bbl. daily. The government repaid more than $5 million to Iraq Petroleum Co. on a loan made to the former government after the destruction of IPC facilities in Syria during the Suez crisis.

BY ED McGHEE
Drilling Editor

AUTOMATIC OPTIMUM CONTROL COMING SOON?



In what the Journal's drilling editor calls a "breakthrough," now a sound mathematical answer can be made to the question . . .

What weight and speed produce the

THERE IS a widely held belief that rotary drilling has gone about as far as it can go. Many have concluded we must find some drastically new method if drilling times are to be shortened appreciably.

This is not true.

Field tests now under way have greatly reduced drilling times without adding a single new piece of equipment to the rig.

Key to this success is in those two commonplaces: bit weight and rotary speed.

The new advance with these old commodities is the result of picking weights and speeds on the basis of scientific fact rather than on personal experience. Improvement resulting from the scientific approach has been so great that many engineers believe such methods could cut 10% off drilling cost of the average U. S. well.

Most of the groundwork needed to determine weight and speed scientifically is now laid. The methods are now being field tested to verify and refine the calculations. While these field tests will doubtless continue for many months, it may be possible within the year to reduce the calculations into a form for general use.

Seeking the optimum. In the preceding paragraphs, we have mentioned only improved drilling time. Of course, the actual goal is finding those combinations of weight and speed which produce the lowest possible cost per foot of hole drilled. The values of weight and speed which do give lowest cost are called the optimum.

The question naturally arises, "If optimum weight and speed mean so much, why haven't such methods been used before?" The reason is that until recently, there simply wasn't enough information available to make possible a determination of optimum values by scientific or any other means.

In the past several months a breakthrough has finally made possible a sound mathematical determination of optimum drilling conditions. This last link in the chain was forged as a result of 2 years of theoretical and field experimental work done by Hughes Tool Co.

The idea behind Hughes' approach is that the drilling properties of a new bit are different from those of a dull bit and probably the best weight and rotary speed should be different for a new bit from those for a dull bit. Many drillers recognized this in the past and used low weight at the start of a bit run, gradually increasing weight until it was extremely heavy by the time the bit was pulled. Usually rotary speed is held essentially constant during the entire bit run.

Hughes searched for a mathematical approach to determine the weight and rotary speed that should be applied at every instant during the life of the bit so that lowest drilling cost results. The company finally succeeded where many had failed in the past.

The company has written mathematic expressions for:

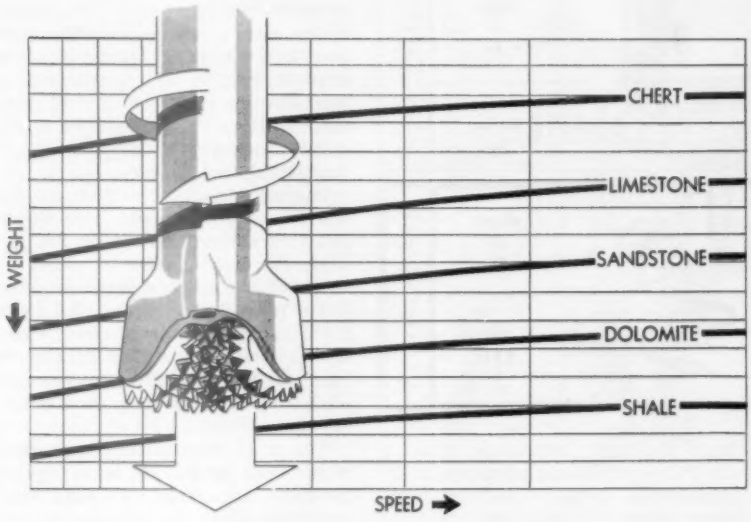
1. The drilling rate of a rock bit in terms of rock properties, weight, rotary speed, and the degree of dullness of the bit.

2. The rate of wear of rock-bit teeth in terms of rock properties, weight, rotary speed, and degree of dullness of the bit.

3. The rate of rock-bit bearing wear in terms of mud properties, weight, and rotary speed.

From these basic expressions, the calculus of variations was used to determine how weight and rotary speed should be varied as drilling progresses. To understand the calculus of variations, consider a classical problem solved by this method: The grading of a ski path from the top of a hill to a

"The companies working with optimum drilling methods emphasize that calculated weights and speeds are no substitute for other good drilling practice. Indeed, advantages of optimum methods can be canceled out if hydraulics are poor or an overly high mud weight used."



lowest drilling costs?

point in the valley such that the skier may make his ski run in the least time.

Although the drilling problem is more complicated, the same principles are used. The method determines best weight and rotary speed at every instant during the life of the bit, just as in the ski problem the best elevation at every point on the ski path is found.

Due to the complexity of the drilling problem, Hughes used an electronic computer in performing the required multitude of calculations.

With this bit-wear relationship and others now firmly established, all factors affecting drilling rate can be gathered for computing the optimum weight and speed.

Already using one method. Shell Oil Co. has used a form of the optimum drilling calculations in many of its operations for the past 2 years. This method is described in detail by John W. Speer in his paper which appears in two parts in the Journal issues of March 31 and April 7, 1958. The product of Speer's work is a chart which may be used on the derrick floor. This chart is the only such instrument now available from which a contractor might pick optimum combinations of weight and speed for his own operations.

When these pioneering Shell charts were evolved, they were based on all the scientifically obtained relations available at the time. Bit-wear relationships were developed from extensive field tests. Thus, the charts are necessarily empirical in part, but they allowed Speer to include some factors (such as hydraulic horsepower and bit balling) which may not appear in later methods.

The charts have cut drilling time in many Shell wells spectacularly. And, this success has inspired other oil companies to make their own investigations of optimum drilling.

Preston L. Moore, formerly of Humble Oil & Refining Co. and now of University of Oklahoma, made a fresh approach using even analytical values. Moore's paper, presented in the Journal, October 6, 1958, served as a basis for Humble's further progress as described by J. W. Graham and N. L. Muench in a recent SPE paper. The company has now extended its work, using the Hughes bit-tooth-wear data.

Hughes' latest investigations have not yet been published, but further field tests are planned for early 1960.

What a foot of hole costs. Just how does one go about finding the optimum weight and speed which result in the lowest possible cost per foot? As a start, we can show what any foot of hole costs to drill. (See below.) Hourly rig cost we should already know for any particular rig; footage to be drilled is also known.

Bit cost depends on price of each bit and total bits used. Trip time also depends on number of bits used but varies with depth of trips as well. Obviously, rotating time is a function of the drilling rate.

Thus, we are left with only three things to determine: drilling rate; number of bits to be used, or life of each bit; and depth of each round trip.

A number of things combine to set drilling rate:

1. Drillability of the formation.
2. Type and condition of bit.
3. Weight of drilling fluid.
4. Hydraulic program.
5. Bit weight.
6. Rotary speed.

Some of these same factors plus others affect bit life:

1. Abrasiveness of the formation.
2. Type of bit.
3. Effect of the drilling fluid.
4. Rotary speed.
5. Bit weight.

We can get a figure for depth of each round trip when we figure what the life of each bit will be.

It isn't our purpose here to investigate hydraulics or the type of bit best suited to a particular formation. We shall assume the bit and hydraulics are the best available. And we shall assume the weight of the mud is the lowest possible and all other mud properties help promote the drilling rate.

This leaves us with certain factors about which we can do nothing:

1. Drillability of the formation.
2. Abrasiveness of the formation.
3. Effect of the mud on bit life.

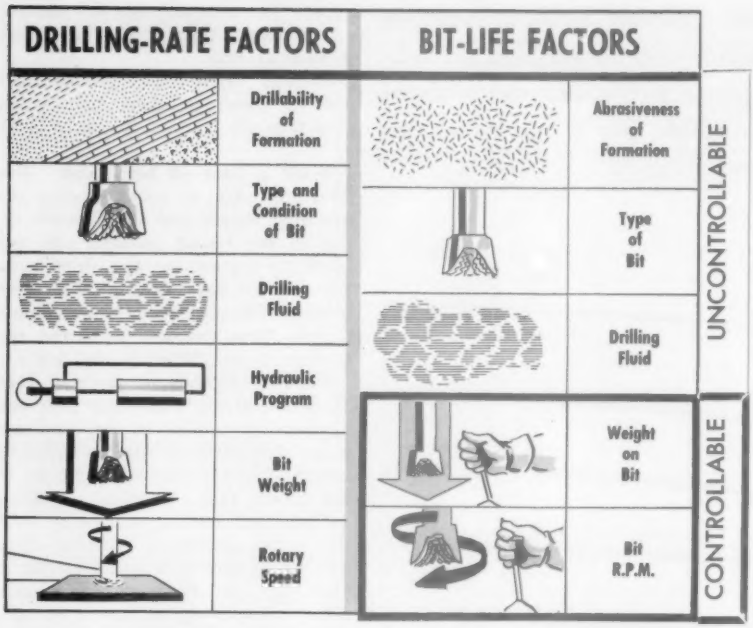
And we have the two factors which we can control and vary for best results:

1. Bit weight.
2. Rotary speed.

Noncontrollables. Drillability of a

HOW TO FIGURE WHAT A FOOT OF HOLE COSTS

$$\text{Drilling cost per foot} = \frac{(\text{Trip time} + \text{rotating time})(\text{hourly rig cost}) + \text{bit cost}}{\text{Well footage to be drilled}}$$



formation depends on many things, two of which are rock strength and depth. Unfortunately, there's no way to predict drillability without actually drilling the rock. For this reason the figures used for formation drillability in calculating optimum conditions must be taken from records of previous wells.

It is, however, possible to make small corrections in the drillability figures to account for changes in formation depth from well to well.

Just as you'd suspect, any formation is more drillable to a sharp, new bit than to an old, dull bit. It is this fact which makes abrasiveness of the formation important. For, certainly, an abrasive formation which dulls bits quickly will be slower to drill than a formation of the same strength and depth but which is less abrasive.

Finding a figure for abrasiveness is a concept put into actual numbers by Hughes Tool researchers. These men discussed the concept at the recent spring meeting of API's Southwestern District Division of Production in Dallas.

Bit bearings last longer in some drilling fluids than in others. Thus, calculations must include a correction factor to reflect probable bit-bearing life in the mud being used.

Speed and weight. We have known for some time the effect of rotary speed on drilling rate. The relationship is not, as many assumed, linear; that is, doubling rotary speed does not double drilling rate.

Laboratory tests by several companies and field tests by a committee of the American Association of Oil Well Drilling Contractors show a more nearly accurate relationship. Instantaneous drilling rate varies as some power less than one of rotary speed. It appears that the power is about 0.43 for hardest rocks and about 0.75 for some of the softest.

That is, doubling rotary speed might increase drilling rate by as little as one-half.

On the other hand, drilling rate goes up approximately as the first power of bit weight; doubling weight roughly doubles drilling rate. In this discussion, we assume that it is not necessary to limit bit weight because of crooked hole or the like.

Besides these apparent effects, bit weight and rotary speed have more obscure results: on bit-bearing wear and on bit-tooth wear. We have already mentioned the tooth-wear effects. The present thinking about bit-bearing wear is best presented in the paper written by George R. King, Hughes Tool, published in The Oil and Gas Journal, November 16, 1959. From this study we can predict with some certainty how any increase in either speed or weight will increase bearing wear.

Generally, with bit weight held constant, the bearings last about the same number of revolutions regardless of the speed. That is, the relation is linear. Doubling speed cuts in half the hours of bearing life. Bearing wear rate seems to remain constant through most of a run. The bearing begins to wear quite rapidly only just prior complete failure.

Putting it all together. Thus, we seek to discover that combination of drilling rate and bit life which minimizes the cost of drilling each foot of hole. But we can see that drilling rate and bit life are tied inseparably together. To find the optimum, we must take hole conditions as we find them, juggling weight and speed in light of those conditions.

None of the early approaches to optimum drilling varied bit weight during a run. Both weight and speed were held constant. Generally, these constant weights and speeds were a great improvement over former practice, but they are still inferior to the system originated by Hughes Tool of changing during the run.

Hughes' results show that, to obtain lowest drilling cost, both weight and rotary speed should be progressively increased as the bit dulls. As an example, study of a particular West Texas formation indicated that, with a 7⅞-in. bit, weight and rotary speed should vary from 50,000 lb. and 24 r.p.m. at the start of the bit run to 60,000 lb. and 78 r.p.m. just before the bit is pulled.

Values of weight and rotary speed in the example are not at all typical. In fact, in another situation they would be different depending on formation properties, mud properties, bit costs, rig costs, and depth of hole.

However, all examples studied indicate that, for lowest drilling cost, initial rotary speed should be quite low and as the bit dulls, the increase in rotary speed should be proportionally much higher than the increase in weight.

Theoretically, the procedure should result in a 10% reduction in drilling cost as compared to the best constant weight and rotary speed. Field tests on two wells indicate that this saving can be effected in practice.

Rig time very important. Optimum bit weight and rotary speed vary in another sense, in that they can be quite different for rigs of different hourly operating costs. Consider two rigs drilling the same hole but one costing $1,000 per day and the other only $500.

Weights and speeds would be higher (and bit life shorter) on the $1,000 rig. This is because rig time is quite expensive in proportion to cost of bits; the optimum would tend to conserve time rather than bits.

On the other hand, weights and speeds would be lower (and bit life longer) on the $500 rig. Reason is that bit cost is high compared to cost of rig time. Thus, the optimum tends to conserve the bit.

Hughes Tool discovered that drillability of the formation actually has nothing to do with deciding optimum weight and speed. That is, strange as

it seems, weight and speed calculate out precisely the same in the hardest formation as they do in the softest, as long as rig cost, bit cost, depth, and formation abrasiveness are the same.

Of course, drillability is a big factor in determining dollar cost of a foot of hole; everyone knows drilling is cheaper in soft rocks than in hard. Nevertheless, in optimum calculations, drillability drops out of the equations for figuring weight and speed. As a result of this discovery and other optimum-drilling data, it's likely that drilling practice for soft-rock areas will be brought closer to the weights and speeds already used in hard-rock locales.

Finding a usable form. We have mentioned no fewer than 13 variables which are important in determining cost of drilling a foot of hole. There are others. While we have nearly exact information on how almost all these variables affect that cost, it is still no easy matter to reduce all this information into an easily used form. After all, we need a method that allows quick computation of the optimum for a particular rig on a particular well.

Some companies are thinking in terms of developing a family of graphs or curves like those used to calculate rig-hydraulics programs. Obviously, such curves would be cheap and fairly simple to use.

Other companies are, for the present, staying with electronic computers. Into the computer they put all the pertinent information on a particular well and rig. Out of it they get a program of weights and speeds and bit runs. This program they take to the rig before the well is spudded.

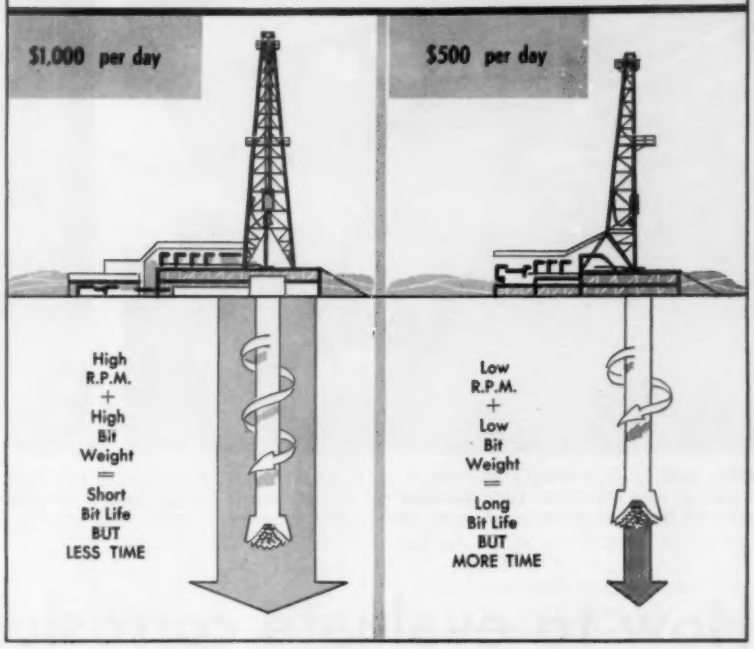
The computed program is followed in a fairly rigid manner and it is difficult to make changes to allow for the cases when values for such things as formation hardness and abrasiveness turn out different from those used in calculation.

In spite of the inflexibility of this method, it may eventually prove the best and simplest solution. As more optimum-drilling tests are made and more exact information is acquired, the computers could produce drilling programs that would require few changes. And it would be unnecessary to have an engineer supervise the program on the rig.

In years to come, it may even become practical to use a computer on every rig. It is possible that such a computer could monitor well depth as well as rotary speed and bit weight. From these values, the computer might be able to infer drillability and perhaps even abrasiveness. Thus it could give a continuous indication of optimum weight and speed.

It would be a relatively simple matter to instrument the computer to control weight and speed. Then it could automatically adjust these things.

DAY RATES INFLUENCE OPTIMUM OPERATIONS


$1,000 per day
$500 per day
High R.P.M. + High Bit Weight = Short Bit Life BUT LESS TIME
Low R.P.M. + Low Bit Weight = Long Bit Life BUT MORE TIME

Notes from field. Most of today's rigs have only a few speeds at which the rotary may be turned. One oil company speculates that this fact will not be a great advantage. This company expects to use the existing rotary speed nearest calculated optimum. Then, weight will be recalculated to be optimum for that particular speed.

This operator believes that resulting drilling cost will seldom be more than about 5% off the calculated absolute optimum.

Calculated speeds have been amazingly low in some cases. Often, a speed of 20 r.p.m. or less has been shown as optimum at the beginning of a run. This speed is so much slower than common practice that many find it hard to believe. Rig crews sometimes cannot be convinced beforehand that the bit will drill at all at such a snail's pace.

Nevertheless, there has been no modification thus far to revise these slow speeds upwards. Some engineers speculate slightly faster rotary speeds may eventually prove closer to actual optimum.

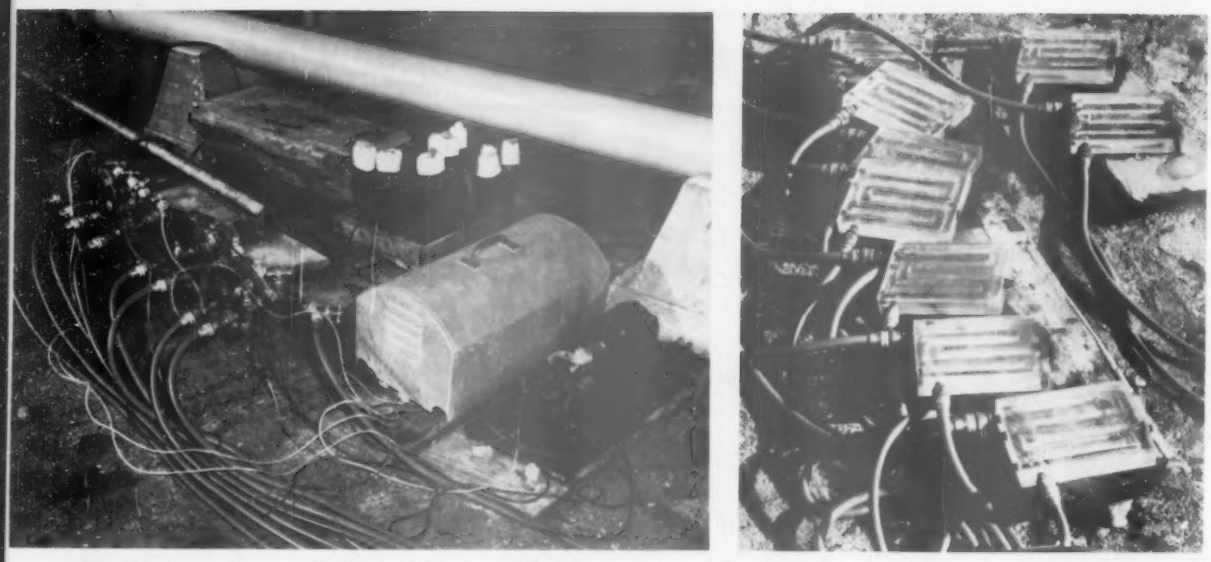
Bit weights calculated as optimum have almost always been higher than current field practice. (However, there has not been an unusual number of bit cones lost in wells drilled for optimum.) Calculations of bit life have purposely been made conservative to avoid losing cones in the hole.

In fast-drilling areas like the Gulf Coast, most of the optimum-drilling work has been done below 5,000 ft. Reason is that basic equations don't reflect the fact that bits tend to ball in some formations above that depth. And, obviously, a balled bit makes it foolish to blindly follow a precalculated program of weights and speeds. Later work may enable the basic equations to predict such balling with a higher degree of accuracy.

In hard-rock areas, there is no reason why optimum weights and speeds cannot be calculated and used from the surface to total depth.

Not a substitute. The companies working with optimum drilling methods emphasize that calculated weights and speeds are no substitute for other good drilling practice. In fact, all the advantages of the optimum methods can be canceled out if hydraulics are poor or if an overly high mud weight is used.

Should there be a tendency toward crooked hole, calculated optimum weight likely will be entirely too high to maintain an acceptable hole angle. In such case, drill-collar size and stabilizer placement must be properly calculated for cheapest results.



FIELD TEST is used to evaluate effectiveness of inhibitors. As shown at left, various inhibitors are injected into streams of water at the manifold. Long sections (25 ft.) of plastic tubing assure adequate mixing by the time water reaches test cells at right. Electrical resistance probes and coupons in each cell measure corrosion rate.

How to evaluate corrosion inhibitors

. . . used in sea water-flood projects

BY CHARLES C. WRIGHT

. . . president of Oilwell Research, Inc., which position he has held since 1950. He is also lecturer at University of Southern California on oil-well drilling fluids, completion practices, and well stimulation. Previous professional experience includes 1 year as a consulting chemist and 2 years as a research chemist with A. R. Mass Chemical Co. Wright is a chemistry graduate of University of California at Los Angeles.

SEVERAL YEARS' EXPERIENCE with sea water at flood projects in California's Wilmington field has shown it capable of causing severe corrosion if the water is not properly inhibited.

Determining which inhibitors provide the best protection requires that simple, reliable procedures be established. Cut-and-try methods are too time consuming and may lead to expensive repair jobs. The laboratory and field methods outlined here may not be the final word. They are the best known today, however, and have been found to give a realistic evaluation of corrosion inhibitors and bactericides.

Operators in the Long Beach Harbor and Terminal Island area ultimately will be injecting 1,000,000 bbl. of ocean water into the fields' five upper-most pay zones. They are seeking to curb land subsidence as well as increase oil recoveries. Current injection rate is more than 400,000 bbl. daily and is continually increasing as more injection wells are added. The eight completed injection plants can provide a total of 912,000 bbl. of water daily.

Nature of water. Almost all of the water used in the floods is obtained from source wells bottomed in sands at depths between 65 and 500 ft. The zone is a fresh-water aquifer which has been invaded by sea water. The water produced is sea water in nature, although it may vary from the full concentration of ocean brine to one only 20% as briny as sea water. Except at two plants, the water ranges from 80 to 100% of the salinity of sea water.

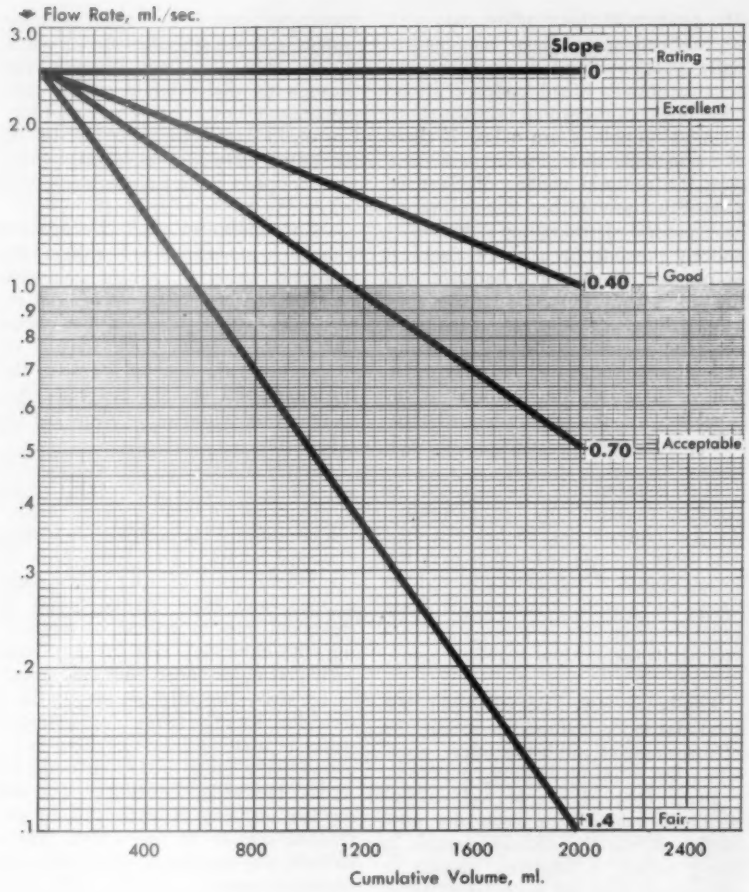
The water is oxygen-free and has a biological oxygen demand of about 25 p.p.m. A typical analysis is given in the accompanying table.

The low turbidity of the water makes filtration unnecessary. Any sand in the water is removed either in settling tanks or in cyclone desanders.

Types of corrosion. Evidence to date indicates the sea water is causing at least two types of corrosion.[1]

First, there is that which, for lack of a better term, can be called chemical corrosion—contact of water with metal surfaces. This type, over long periods of time, results in a corrosion rate of about 3 m.p.y. Whenever the water supply is upset, such as by the admission of air, the rate climbs to a value considerably higher.

The second cause of corrosion is bacterial attack. Experience with untreated field systems has shown the



MEMBRANE-FILTER TEST determines the solubility or dispersibility of inhibitors in sea water.

single compound may be capable of fulfilling all requirements.

Test procedures. The series of tests outlined here has been developed to allow a selection of inhibitors most likely to succeed in Wilmington field systems. The tests are used solely for screening and not for final evaluation. A material which will pass these tests, however, has a high probability of being successful in the field and will merit further field testing.

The tests used are: (1) The membrane filter test, (2) bacteriostatic test, (3) corrosion-inhibition test (laboratory), and (4) corrosion-inhibition test (dynamic field test). The normal practice is to start with the simplest test, then run the compound through each test in succession. If a chemical fails one test, it is not further evaluated.

Membrane filter test. Primary purpose of the membrane filter test in evaluating flood waters is to determine the plugging tendency of the water.[3,4,5,6] As a tool for evaluating the effectiveness of corrosion inhibitors, the test is used to ascertain the degree of solubility or dispersibility of the inhibitor in the flood water.

3-m.p.y. rate can be expected to hold true until bacterial growth has become well established. This is usually somewhere between 6 and 9 months after the system is placed in operation. Once bacterial growth is well established, pitting begins. Some 6 to 9 months from that date bacterial attack can be expected to cause perforations in the surface pipe.

Sulfate-reducing bacteria (desulfovibrio) are believed to be responsible for most of the bacterial attack. However, other sulfide-producing bacteria, Clostridia, have been found. These obligate anaerobic bacteria obtain their sulfur from the decomposition of organic material (such as sewage). As they are spore formers, continuous inhibition is necessary if they are to be kept inactive.[2]

Control procedures until quite recently were limited to use of a corrosion inhibitor. This generally prevented perforation of the pipe even though bacterial growth occurred. To obtain a higher degree of control, however, the practice now is to supplement the corrosion inhibitor with an effective bactericide. This has led to use of two chemicals, although a

GEOCHEMICAL ANALYSIS OF SEA WATER OBTAINED FROM A SHALLOW SOURCE WELL.

Radicals	Milligrams per liter	Grains per U.S. gallon	Reacting value	Per cent
Sodium, (Na)	7,210	421.1	313.59	35.08
Ammonium, (NH_4)	12.5	0.73	9.69	0.08
Calcium, (Ca)	586.8	34.28	29.28	3.28
Magnesium, (Mg)	1,256	73.36	103.29	11.56
Barium, (Ba)	1.4	0.08	0.02	....
Iron, (Fe)	3.5	0.20	....	....
Sulfate, (SO_4)	2,600	151.9	54.13	6.06
Chloride, (C1)	18,580	1,085	386.84	43.28
Carbonate, (CO_3)	.....	.....	....	....
Bicarbonate, (HCO_3)	350.8	20.49	5.75	0.64
Borate, (B_4O_7)	11.7	0.68	0.15	0.02
Iodide, (I)	0	0	0	0
Silica, (SiO_2)	22.5	1.31	....	....
Sulfide, (S)	0.02	.....	....	....
Salinity as salt, (NaCl)	30,630	1,789	....	....
Total solids	30,635.4	.....	....	....
Specific gravity at 60° F.	1.027	.....	....	....

Resistivity
24.3 ohm. cm. at 75° F.
pH value 7.6

Groups		Chemical character	
Alkalies	35.16%	Primary salinity	70.32%
Earths	14.84%	Secondary salinity	28.36%
Strong acids	49.34%	Primary alkalinity	.....
Weak acids	0.66%	Secondary alkalinity	1.32%

Many inhibitors are not soluble in sea water but are dispersible. The plugging rate on the membrane filter tells the degree of compatibility. A poorly dispersible inhibitor will give a milky water, and will reduce the flow rate through the membrane filter to less than 0.1 ml. per second, with less than 300 ml. total throughput.

A membrane filter, 70 mm. in diameter and having a pore size of 0.45 μ ($\pm$ 0.02), is used. The test is run using the treated water in a closed system and under a nitrogen blanket. A constant pressure of 4 ft. of water is maintained on the filter. The test is run at a source well, at prevailing water temperatures.

The filter discharge is measured for the first minute, and for each 3 minutes thereafter until 2,000 ml. have passed through or 60 minutes have elapsed. The flow rate then is calculated and plotted against the cumulative volume throughout, as shown in the accompanying diagram.

The slope is calculated by measuring the linear vertical distance between the zero point of the curve and the end of the curve. This linear distance is laid along the horizontal axis and read in terms of volume. The slope is this volume divided by the total volume through the filter.

How the performance of an inhibitor is rated is shown on the diagram. If there is little or no drop in the flow rate of the treated water during the test, the inhibitor is judged as excellent. The steeper the slope of a curve the less dispersable or soluble the inhibitor.

Bacteriostatic tests. The procedure outlined in API RP 38, "Recommended Practice for Biological Analysis of Water-Flood Injection Waters," is followed except for a few modifications.[7] These include:

Sterilized sea water, as obtained from the source well, is used in lieu of distilled water and salt in making up the nutrient. This includes the broth and the inoculation medium.

A pure culture of desulfovibrio is not used. Instead a mixed culture is used. It is made up of all the sulfide-producing bacteria which will grow in the deep agar counting tubes (made up with sterilized brine). This mixed culture is believed to be a mixture of sulfate-reducing (desulfovibrio) and sulfide-producing (clostridia) bacteria.

This procedure has proved valuable for screening the effectiveness of various chemicals as bactericides. Being a growth-inhibition test, however, the method has several limitations.

One is that the ingredients of the nutrient media may, and often do, react with the bactericide under test. The product of this reaction may well be ineffective, resulting in a potentially good material being ruled out because it was tested under artificial conditions. To correct this situation, chemical suppliers are asked if there is a possibility their product will react with the nutrient media. If there is, a modified test is run.

A second shortcoming is that it is entirely possible for a given chemical to prevent growth of a bacteria, but not kill them. Thus a situation may arise where, as long as there is a respectable concentration of the chemical present, there will be no growth. But as soon as the chemical is diluted beyond certain limiting concentrations, bacterial growth will continue.

It is believed this objection can be partially overcome by further testing. At the end of the 30-day test, the two tubes are selected which have the lowest chemical concentration and yet show no growth. Contents of these tubes then are used to make a bacteria culture in the normal manner.

Pop-bottle test. The pop-bottle test is a laboratory method for testing the effectiveness of inhibitors under simulated, but controlled, field conditions.

Brine from a source well is immediately added to a clean, dry pop-bottle. While the 185-ml. sample is being added, a nitrogen blanket is maintained over the water at all times in order to prevent contact with air. If a corrosion inhibitor is to be evaluated, the desired amount is placed in the bottle prior to adding the water.

A sandblasted steel shim-stock coupon, ½ by 7¼ by 25/1,000 in., is then placed in the bottle and the bottle sealed with a cap.

A wheel which can accommodate 11 bottles is used as the agitating medium. The samples are mounted with the top inward. By means of a shaft, the wheel is turned at the rate of 30 r.p.m. for a 24-hour period. The whole assembly is mounted in a thermostated oven which is maintained at a temperature of 90° F.

After rotation, the bottles are taken from the oven and the coupons removed. By recleaning and reweighing the coupons, the weight lost during the exposure period is determined.

This test also has disadvantages. A poorly or sparingly soluble inhibitor, or one that is poorly dispersible, may appear much better because of the continued agitation. Also, it is strictly a chemical-attack test. There is no bacterial corrosion.

Field-test method. Final method of evaluating an inhibitor's effectiveness is a field test under conditions approaching those in the actual injection system. A stream of water from a source well (or field line) is run through parallel lines to plastic cells containing corrosion-sensing units. Corrosion rates are measured by means of electrical resistance probes and coupons inserted in each test cell.[8 9 10]

Chemicals to be tested are injected into each stream of water near the manifold, using a moving sine-wave type of plastic tubing pump. To insure adequate dispersal of the chemical in the water, 25-ft. lengths of plastic hose are inserted between the injection point and the test cells. Accompanying photographs show the arrangement.

Results with these devices do not duplicate corrosion rates experienced in the actual injection systems. Under test conditions, the corrosion is strictly chemical attack. But some idea of the effectiveness of various compounds, and their desired levels of treatment, can be gained by comparing the inhibited rate of corrosion with that experienced with raw water.

To study the effectiveness of bactericides, bacterially contaminated water is used and enough time is allowed for a good growth to build up in the test cells. Tests are also run on the effluent of each cell to determine quality of the water. These include the membrane filter test and bacterial counts.

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Nelson Refinery Cost Indexes

Published in the first issue each month in the Technology-Operating.

Compiled by W. L. Nelson, technical editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the month of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis)

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1957	1958	1959	Oct. 1959
Pumps, compressors, etc.	138.2	166.5	206.7	214.7	226.5	226.5
Electrical machinery	134.9	160.0	188.9	192.7	195.8	197.7
Internal-combustion engines	126.0	150.5	173.9	178.3	178.5	177.9
Instruments	127.8	154.6	187.4	194.9	201.0	198.6
Heat exchangers	140.0	171.7	203.6	181.2	178.9	180.0
Misc. equipment average	*126.2	160.7	192.1	192.4	196.1	196.1
Materials component	149.5	174.6	201.9	204.2	207.8	208.4
Labor component	144.0	183.3	208.6	220.4	231.6	236.2
Nelson construction index	146.2	179.8	205.9	213.9	222.1	225.1

*Used in computing the Nelson Index until April 1952.

Refinery Operating Cost Indexes (1956 Basis)

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1957	1958	Sept. 1959
Fuel cost	49.6	81.0	86.5	112.4	102.6	102.4
Labor cost	73.1	88.7	90.9	106.1	105.0	105.4
Wages	52.4	81.5	88.7	104.1	105.4	114.7
Productivity	68.3	90.2	97.1	98.1	100.3	108.8
Investment, maintenance, etc.	51.2	83.6	92.0	105.4	109.5	115.1
Chemicals cost	37.0	72.1	85.7	102.2	104.4	112.3
Operating cost indexes:						
Refinery	58.5	80.5	88.7	106.4	195.9	108.9
Process units†	62.9	82.2	88.4	107.1	105.8	107.7

†Add separate index for chemicals, if any are used.

BOOK REVIEWS

INDUSTRIAL COMPLEX ANALYSIS AND REGIONAL DEVELOPMENT. By Walter Isard, Eugene W. Schooler, and Thomas Vietorisz. Published by the Technology Press, Massachusetts Institute of Technology, and John Wiley & Sons, Inc., 440 Fourth Avenue, New York City 16. $8.75. 294 pp.

This book develops, by means of a case study, a technique for comparing the locational advantages and disadvantages of regions relative to the operation of a set of strongly interrelated industrial activities.

This technique achieves the major objectives of an inter-industry approach while sacrificing none of the detailed analysis of the individual industry comparative cost approach. It permits consideration and comparison of the quantitative and qualitative aspects of regional advantage.

The case study, relative to oil refinery, petrochemical, and synthetic-fiber activity combinations in Puerto Rico, illustrates the analytical method in detail.

It is of further interest in that it indicates not only Puerto Rico's locational advantages, but also the favorable effect this type of complex could have on Puerto Rico's general economic development.

A TECHNICAL WRITER'S HANDBOOK. By Margaret Norgaard. Published by Harper & Bros., 49 East Thirty-third Street, New York City 16. $3.75. 241 pp.

This book covers all aspects of technical writing and deals with such questions as: What is good technical writing? Who reads technical literature, and what are the emotional factors that color understanding of technical fact? What are the basic methods of research? What are the modern practices in grammar and punctuation, and the logical reasoning behind them? Where is the application of logic to technical writing? What constitutes good writing style?

Included are a complete grammar section, stressing modern usage, a punctuation guide, and an analysis of the emotional factors that sway readers. An appendix includes examples of different types of good technical writing.

OIL ON STREAM! By John L. Loos. Published by Louisiana State University Press, Baton Rouge 3. $6. 411 pp.

This book is a history of Interstate Oil Pipe Line Co. from 1909 until 1959. It describes all aspects of the company's operations—the construction of the original trunk line system running from near Tulsa to Baton Rouge; early living and working conditions; the growth of the system to more than 4,500 miles of trunk and gathering lines; the changes in technique and equipment that have occurred over half a century; the company's dealings with landowners and its relations with the Standard Oil Co. (N. J.); employe-management relations; and regulation by state and federal governments.

OIL AND STATE IN THE MIDDLE EAST. By George Lenczowski. Published by Cornell University Press, 124 Roberts Place, Ithaca, N. Y. $6.75. 379 pp.

The author explores the question of how the foreign-owned oil industry can best survive and prosper in the social and political situation in the Middle East.

After reviewing the significance of oil in the European economy and its impact on Middle East development, the author takes up in detail the characteristics and legal status of the concession agreement. To cover the whole sector of human and industrial relations, he then analyzes the industry's contacts with three elements: the host governments, the public in host countries, and the employes—examining the economic, legal, social, and political aspects involved.

Labor problems, strikes, territorial claims in submarine and desert areas, and the use of public relations techniques are a few of the topics which come under discussion.

His case study of the Suez crisis further points up the many facets of the state-company relationship and the interdependence of politics, mass psychology, and economics as factors which influence the position of the oil industry.

THE SEA OFF SOUTHERN CALIFORNIA: A MODERN HABITAT OF PETROLEUM. By K. O. Emery. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York City 16. $12.50. 366 pp.

Although much work has been done on various aspects of the sea floor, the water, and the marine life off California, little summarization and few conclusions exist. This book presents a full-scale treatment of the Southern California underwater area.

The author describes the tie between physiography, structure, water, life, and sediments in the ocean. He also discusses the influence of these things on the origin, migration, and accumulation of petroleum.

Featuring a close tie between text and illustrations, the book contains answers to questions of interest to oil geologists and oil companies, such as the distribution of rocks to various ages off shore, the locations of oil seeps, and the heights of waves.

Of more fundamental interest is the inclusion of new data on the origin of oil: the dependence of hydrocarbons on environmental factors such as production of phytoplankton, oxidation, and dilution by detrital sediment.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

Implosions improve well injectivity

New method helps wells accept acid and other stimulating fluids. Implosion technique opens the way for successful fracturing of hard-to-fracture formations.

BY D. D. SETSER AND J. P. MORAN
Dowell Division of Dow Chemical Co., Tulsa

A NEW well-stimulation device, known as an implosion capsule, has been developed for use in gas, oil, and water wells.

Experimental tests, conducted in wells in various parts of the country, show that this device is capable of providing worth-while benefits to many wells previously considered unsuitable for treatment. The implosion method consists of lowering an implosion capsule or capsules into a well to the depth where selective stimulation is desired. Pressure is applied to the capsule through the surrounding fluid medium until the capsule collapses and an implosion takes place. The equalization of pressures in the space previously occupied by the capsule creates shock waves which strongly affect the formation immediately adjacent to the imploding capsule.

Success of both acidizing and fracturing treatments is dependent on injection of treating fluids into the formation rock. Occasionally, extremely dense, low-permeability formations are encountered that do not accept fluid readily. Surface-treating pressures that would be required to attain the necessary injection rate exceed the pressure limitations of the well equipment. Mud cake on the surface of the well bore or a mud block in the formation adjacent to the well bore may restrict injection of treating fluids within the prescribed pressure limits. In such cases, stimulation treatments must be modified to overcome these conditions, and such treatments often result in failure.

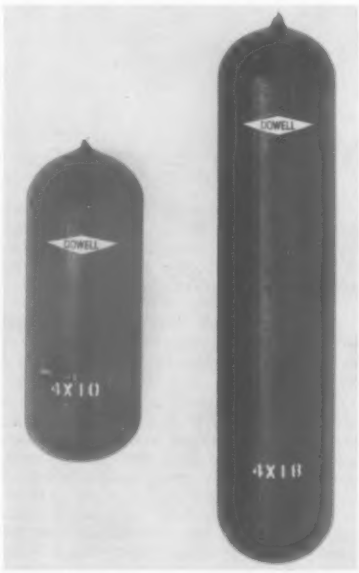
Another difficulty is sometimes encountered in wells having more than one productive section. If the zone in which the stimulation treatment is to be applied has low injectivity, and another zone is open and accepts fluid readily, it is difficult to selectively treat the tighter zone without the aid of mechanical tools or temporary plugging agents.

In recent years, new methods have been developed to initiate fractures in a formation at a preselected depth, prior to a stimulation treatment. Such methods include the use of grouped explosive charges, artificial notching by cutting the casing and formation with a mechanical cutter, or by jetting high-velocity sand-fluid streams that will perforate and erode cavities in the formation rock.

The use of implosion capsules is the latest development in selective fracture initiation, and for lowering the injection pressure of dense zones.

Opposite of explosion. The phenomenon known as implosion is the exact opposite of the more familiar explosion. The latter results from the sudden release of a high-pressure nucleus into a surrounding low-pressure medium. An implosion, on the other hand, results from the sudden collapse of a low-pressure nucleus surrounded by a high-pressure medium. The breaking of an evacuated light-bulb is an example of a weak implosion. When the bulb is broken, surrounding air, at atmospheric pressure, rushes inward to fill the vacuum. This inrushing air produces a shock wave, the violence of which is proportional to the differential pressure inside and outside the bulb before it was broken.

Different lengths and diameters. The implosion capsules used for well stimulation basically consist of strong-welled evacuated glass cylinders, designed to withstand high well-bore pressures. These capsules are made from thick-walled pyrex glass, and come in different diameters to fit different casing sizes, and in various lengths, as shown in Fig. 1. They are designed to implode upon the application of predetermined amounts of external pressure.



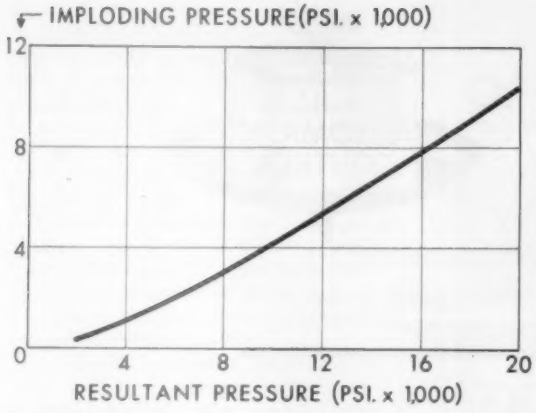
IMPLOSION CAPSULES are made in different lengths, diameters, and wall thicknesses, designed for specific jobs under varying conditions. Fig. 1.

Care must be taken in selecting the size capsule to be used in a well, so that its yield or collapsing pressure is greater than the hydrostatic pressure in the well at the selected depth so as to prevent premature implosion. Once the capsule is in place, additional pressure may be applied from the surface, by means of mobile pumping equipment, until the critical pressure of the capsule is reached. As the capsule collapses, the resulting implosion produces two almost instantaneous shock reactions, which have a profound effect upon the adjacent formation.

Initial reaction. The first phase of the implosion is an inward rush of pressurized fluid into the low-pressure cavity left by the collapsing capsule. The velocity of this fluid moving into the void ranges from 100 to 800 m.p.h., depending on the imploding pressure. The potential energy, stored in the pressurized fluid above the capsule before implosion, is suddenly released as the fluid column moves downward to fill the created void. When this void has been filled, the inertial force of the falling column exerts pressure against the face of the well bore. The resultant high pressure is of short duration, about 0.01 second, and most of the force is limited to the section of formation immediately opposite the capsule.

There is a relationship between the differential pressure required to implode the capsule, and the resulting high pressure that is developed, Fig. 2. The points on the curve were calculated from the mass-velocity relationship, and experimentally verified. From this graph it may be seen that capsules with yield pressures of 2,000 psi. produce a pressure approximately three times as great while capsules

Presented before the Committee on Production Practice at the Southwest District API meeting, Dallas, March 2-4, 1960.



THIS CURVE shows that the pressure required to collapse a capsule is increased many times as a result of the implosion. Fig. 2.

with yield pressures of 10,000 psi. produce a pressure about twice that intensity.

Early development tests on the implosion capsule were conducted in sections of oil-well casing, suspended in a high-pressure test chamber. Under these conditions, most of the test sections were ripped longitudinally from the force of the implosion. These early tests indicated that this method might not be applicable to a cased hole. Subsequent well tests, both in perforated and blank cemented pipe, showed that the implosion could be controlled so that no such damage to the casing took place. This was evidenced by caliper surveys, made before and after implosion, which showed no detectable change in casing diameter.

Second reaction. The majority of the work done to the formation results from the pressure generated by the second phase of the implosion. The extent of this force may be calculated for an average well application. Assume that a 4-in.-diameter capsule, 14 in. long, is to be imploded in a perforated interval at 3,000 ft. depth in 5½-in. casing. The collapse pressure of this capsule is 3,300 psi. Since the hydrostatic head of water at 3,000 ft. is approximately 1,300 psi., an additional 2,000-psi. surface pressure must be applied to implode the capsule.

When this pressurized fluid falls 14 in. in the well bore, it has developed 48,350 ft.-lb. of energy. This potential energy is released at the instant of implosion, and expends most of its energy as 8,600-psi. pressure against the face of the formation adjacent to the capsule. Subsequently, a diminishing wave action of force is transmitted up and down the casing until all of the energy is released.

It is believed that, during a well treatment, this sudden pressure shatters the adjacent formation, penetrates through localized blocks in the critical area, and provides an easy path for the injection of fluid. Most of the wells experimentally treated with the implosion technique to date have shown marked improvement in injectivity following implosion. It is also believed that numerous short fractures are initiated in the face of the pay, the vertical extent of the fractures being limited by the length of the imploded capsule.

Field test. An example may be cited of a Wyoming wildcat well in which capsules were imploded at depths of 7,070, 7,072, and 7,074 ft., in order to initiate fractures in a thin producing section. It was hoped that this development well, which was making only 7 bbl. oil per day, could be converted into a small oil producer. Previously the well had been perforated, acidized, and fractured without results. Two capsules were imploded in the perforated interval opposite the suspected oil pay. To test the effect of the implosion capsules on the formation, injectivity tests were conducted before and after the implosion. At an injection pressure of 2,200 psig. the injection rate was increased from ½ bbl. per minute before implosion to 3.26 bbl. per minute after implosion.

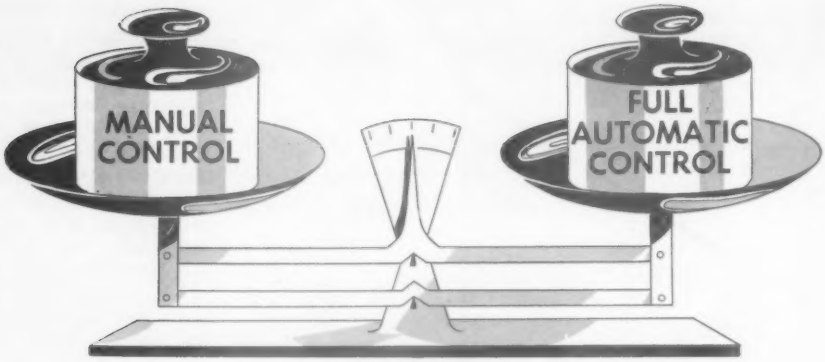
As a result of the implosion treatment **only,** the well began to flow and without further stimulation treatment, production had increased to 20 bbl. oil per day after 2 weeks' time. Results of this treatment indicated that the use of implosion capsules made it possible to fracture this well selectively in the pay zone, whereas previous stimulation treatments had evidently bypassed into unproductive zones.

The majority of the applications for the implosion method to date have been to reduce formation breakdown and injection pressures prior to a fracturing or acidizing treatment. Two recent applications in deep limestone reservoirs of West Texas show the effectiveness of the implosion method for this purpose.

In Upton County, Texas, a deep Ellenburger well was completed in open hole from 12,282 to 12,335 ft. This section of open hole, below 7-in., 26-lb. casing, had been shot with open-hole explosive charges, followed by acidizing. This acidizing attempt proved a failure for a surface treating pressure of 5,400 psi. was attained without feeding the acid into the formation. Four capsules were individually imploded at depths of 12,237, 12,315, 12,313, and 12,311 ft. Following this implosion treatment, the well was acidized with 7,500 gal. of acid through tubing with a set packer in the casing, at the following injection rates: The first 2,500 gal. of acid was injected at 2 bbl. per minute at 4,600 psi.; the second 2,500 gal. at 2½ bbl. per minute at 4,000 psi.; and the remainder at 3 bbl. per minute at 4,000 psi. The shut-in pressure after treatment was 3,600 psi. Three days after treatment, this well was flowing 354 bbl. oil per day through a 20/64-in. choke.

An Andrews County, Texas, well was completed in the Devonian lime with 12 ft. of perforations at 12,485-ft. depth. The well was first perforated with bullets, four shots per foot, then with explosive jet charges, four shots per foot, then abraded in eight places with high-pressure, sand laden fluid jets. Fifteen hundred gallons of acid was then injected into the formation at 5,400 psi., at an injection rate of 2 g.p.m. At this extremely low injection rate, in conjunction with the elevated bottom-hole temperature of the well, it was calculated that the acid would be spent before it had a chance to penetrate very far from the well bore. Four capsules were imploded at depth settings of 12,480, 12,476, 12,472, and 12,468 ft. After implosion, the injection rate was 1½ bbl. per minute at 4,000 psi.

These case histories are typical of those performed during the current field-development program. To date, more than 50 well treatments have been completed, with success. A number of "problem" formations, previously considered incapable of being stimulated, have been successfully acidized or fractured after first being "broken down" by this implosion method. Although still in the development stage, it is believed that this new technique will be of material aid in well-stimulation operations.



Eyeing automatic pipeline control?

Here's a discussion that will be helpful in guiding you toward an economically sound decision

BY GEOFFREY POST
Genesys Corp., Los Angeles

A COMPARISON of the benefits of manual versus full automatic control for gas, crude oil, and product pipelines is essential to satisfy the economic requirements of the buyer and to allow suitable management planning for future requirements.

Undoubtedly, there is confusion between widespread claims of computer manufacturers and initial computer-control efforts by some users raising an issue of doubt about true economic justification. This article will present, in a simplified manner, criteria for evaluation and for the elimination of some of the hazy, commonly accepted falsehoods about control computing.

Intangibles of Computing Control

There are several important reasons for computer control in addition to the obvious tangibles, such as saving manpower and raising routine efficiencies. These have to do with an important concept of systems engineering which can be simply defined for these purposes with the cliche, "plan ahead."

There are, for example, large incremental savings to be achieved if a control system is designed to adapt easily at low cost to the momentous changes which can occur in a pipeline-control requirements in the first 5 or 10 years of operation. These changes include elements due to population growth and urban expansion, growing applications of the newly available products, and tie-in with other lines into more integrated systems. If the pipeline system does not have these types of near-future requirements, economic justification will invariably be lacking.

Unless systems engineering can radically affect your ability to adjust in future operations at low added capital investment and operating costs, computer control is not justified. This also means that the intangible of future growth must be given an important weight in the decision to automate. The weight here is to be higher for the new pipeline under construction since the element of future growth is incrementally quite large.

In the existing pipeline, where there is to be a decision for automation, the weight should be a good deal smaller, but nonetheless important. In the latter situation, an added increment of weight has to be placed on the benefits of earlier integration with other lines where applicable.

The ratio of this intangible weighting on new pipelines should be from 30 to 50% of total justification depending on size of pipeline and market evaluations of area growth. For existing pipelines, the ratio should be 10 to 20% of total justification.

These ratios are based on the added cost of expanding 100% in line capacity and having, by the sheer necessity of control and data-processing requirements involved, to then automate the expanded line. These costs are also based on fixed costs of dollars. If the inflationary rise in electronic-equipment costs proceeds at the present rate in the next few years, this can even be such as to increase this ratio of intangible benefits to total justification.

The next problem is to weigh the implications of possible increased throughput on new needs for developing data-processing communications beyond control-system communication. This is not always obvious in the pipeline system, but it means that the translation of control-system performance into dollars of profit can be lost if the added management and cost-control functions of system operations are not suitably set up for machine reduction.

Thus, as the scope of a pipeline operation grows more complex, especially in tie-in integrations, it is vital that the control system accurately convey its performance data for accounting purposes without manual reinterpretation; otherwise a large time and labor bottleneck will occur. The question is, then, how the system is to be accounted and managed and what price is to be paid in processing this data for sales and management decision when the operation system grows to a certain size.

The issue of basic communications

can be by far the major problem to be considered. Manual operations appear to allow a simple communications structure with a master center station telephone for system control of subsidiary slave stations. As long as the number of slaves per master permits them to be limited by the correlating ability of the dispatcher and his ability to respond to an initial analysis, this system is certainly adequate. This usually means for a line upset that perhaps 1 to 2 hours may be needed to come back to normal integrated operation.

In automatic control, communications can be economic, faster, and more reliable by use of digital communications than a similar network undergoing manual control. The added speed at less band width allows assurance of maximum response to upsets or commands while still allowing voice communications in emergencies or manual tests of the system.

It is vital to the economic justification of full automatic pipeline control that communications be given the tightest qualification. Poor system design here can produce large relative cost upon system growth and complete system breakdown regardless of the other system components' adequacy. It is also here where major adaptability restraints will begin.

Tangible Benefits of Control Computing

The tangibles can be put in seven categories towards increased profits and improved operating conditions:

1. Manpower savings in terms of salaries and wages, fixed charges, overhead, and support facilities.
2. Maintenance, including labor and materials.
3. Fuel and utilities savings.
4. Savings due to optimization locally.
5. Savings due to optimization along the line.
6. Safety.
7. Capital savings.

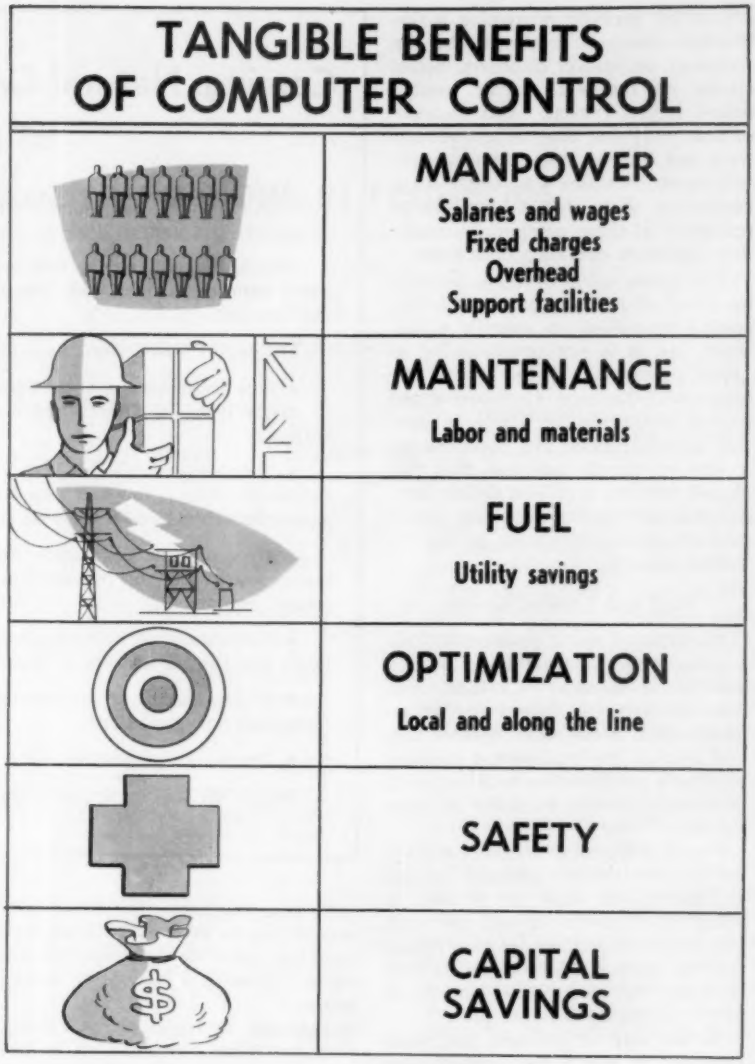
To discuss these further, assume two pipeline system conditions for justification. The first is a new pipeline to be called Condition 1, and the second an existing pipeline to be called Condition 2.

Manpower. Condition 1. In this case the manpower required is less on two points, operation personnel and maintenance personnel. Compressor stations can be completely unmanned with maintenance performed by one crew for three station groups. This can save anywhere from 5 to 20 people per station depending on the support necessary for station personnel.

Assume the minimum savings, which comes to $50,000 a year per station. For a line of 10 stations, this is a savings of $500,000. The dispatching station has no appreciable savings in the first 2 years, but with experience this should be reduced by the safety factor employed initially to allow manual overpowering operation while the system is newly installed.

Support costs depend on how far the comparably manned compressor station would be from the amenities of civilization and what housing, recreation, medical, and transport costs have to be included for remote locations.

Condition 2. Manpower reduction here would be gradual due to labor-union commitments on the basis of reducing in, say, 5 years, from a full complement to full automatic control. This should reach about the same savings as above in 5 years aud should go about 10% the first year (due to break-in safety precautions), 20% the second, third, and fourth years, and 30% in the fifth year.



Maintenance. Condition 1. The savings of maintenance personnel should run about two compressor stations' complement per group of three stations. While it's true that the maintenance requirement for computers is on a higher training level than a mere compressor station, it's at no higher level than is needed for microwave or communication station repair. Support costs should also be cut accordingly.

Condition 2. Here again is a gradual release of personnel over a 5-year program toward the goal of two compressor stations' complement per group of three stations.

Condition 1 and Condition 2. A real major saving can be seen in maintenance costs. The reasons are better

control of periodic preventive maintenance, automatic evaluating by the computer on station disorders, better alarms on trends to repair trouble before it gets critical. Also, because of firm integrated control, less general wear and tear on system components will cause breakdown to occur on a decreasing scale due to continuous operation of these components under their optimum operating conditions.

The dollar value of these depends on effect of periodic unfavorable operating conditions on specific equipment, but it is not unreasonable to expect components to last 15 to 25% longer with this care. Consideriing the capital investment of a line in control intsrumentation and compressors, a rule of thumb indicates that this should run into a million dollars over a 5-year accounting for a line whose over-all capital investment is over 33 million dollars.

Fuel and Utilities Savings

Condition 1 and Condition 2. This expense is tied to whether gas or electric power is used. Consider this point in terms of dollars per horsepower used in the line. Assume natural gas as the transported medium because a products line will require a different criterion to make it more realistic.

For electric-motor station operation, the conservatively estimated savings are at 5% of total power cost or about $2.40 per horsepower per year. For angle reciprocating-station operation, the savings will be closer to 10% allowing for closer line control or $1.20 per horsepower per year.

In the case of products line, optimization is much less sophisticated and should run about 3% of total fuel bill.

Local Optimization Savings

Local optimization means more than the local optimum maintenance and fuel savings. There are also the benefits of steady-state performance and improved communication to present all possible profit data to evaluation.

An automatic pipeline would thus present easily analyzed day-to-day operating data for simple monitoring by the dispatcher computer to give the facts in the desired format to management to adjust control for maximum profit. This is performed on a trial-and-error basis over many months, and a decision can then stand on established performance tests which cannot be run practically in a manual system.

The motive here is to take station efficiency as close to its realizable margins as profitable. The dollar value should run to at least 10% of total operating costs in the initial phases, but is impossible to determine in later phases.

This can be based on an analogy with motor-car operation. It is well known that automobile efficiencies, in terms of most profitable operation, are quite low. Power efficiency, for example, has been estimated at 20%. It is also well known that proper driving habits can raise efficiencies so that mileage can be increased 40% or more for the same investment in fuel. This is the crux of the meaning of optimization. If we know how to operate best by a system analysis, an increase in profits should accordingly occur by automatic control.

Line Optimization Savings

This is the outgrowth of local optimization savings in new efficiencies of getting the most out of stations in a complex network. Here is the effect of pulling together stations which normally have an independence of operation into a cohesive unit under a specified command.

This means better line-pack control, new station efficiencies, since these are taxed for only what is needed, and fastest response of the system to any emergency conditions. The dollar value is impossible to estimate, but it's a tangible benefit because it is dollars returned immediately even in approximate system applications.

Safety

The ability of a computer to explore trends is of great value in confirming line reliability and preventing accidents. For example, the buildup of hydrates in the line could cause conditions leading to a major disorder. The savings made by eliminating one explosion could well pay for the entire computer-control system.

Capital Savings

A good deal of savings in capital investment can be made especially in product lines and natural-gas lines in initial design and construction by installing a control computer in the system. This saving is due expressly to the reduced need for underground storage and the decreased size of the pipe where line pack is practiced in the case of gas lines. In product lines where as many as 20 products may be batched through a line, refinery and terminal storage savings can be very substantial.

Coming: Natural-Gas Pipeline Report
. . . and new wall map

NEXT WEEK, the Journal will bring you a special 35-page report on natural gas and natural-gas pipelines.

This will include **a 3 by 4-ft. wall map showing all existing and proposed natural-gas lines with compressor-station locations** in the U. S. and Canada.

The report will feature such topics as:

- New techniques in natural-gas-pipeline instrumentation. This covers all major types of drivers and compressors used in natural-gas transmission.
- New construction methods on Transwestern's line from Texas to California. This is the first new large project to use high-strength X-56 pipe with welding under extreme cold conditions.
- How pipeline companies and manufacturers are working toward more capacity per ton of steel and more horsepower per dollar in compressor equipment.
- Unitization of compressor stations on Tennessee Gas Pipeline's Delta line from Louisiana to Tennessee.
- A new design for wellhead dehydration units which should bring significant cost reductions.
- The future of domestic natural-gas reserves.

Watch for this important issue March 14.

The
FOREMAN'S PAGE

Here's a look at some of the

Factors which affect fluid flow in refineries

ONE OF the main principles involving fluid flow was developed by a man named Bernoulli. Simply stated, his principle is: When a fluid is in motion, its pressure increases whenever its velocity decreases. Likewise, its pressure decreases whenever its velocity increases. Fig. 2 illustrates this principle.

Any fluid in motion possesses four forms of energy:

Example

1. Potential or head—water at top of tank.
2. Kinetic or velocity—water doing work on water wheel.
3. Static or pressure—pressure exerted inside line.
4. Heat—heat generated in line due to friction.

The total energy that a fluid in motion has at any time is equal to the sum of the forms listed. Because energy can neither be created or destroyed, it is therefore possible to convert one form of energy into another, such as velocity into pressure. Examples of the conversion of energy are:

Pumps—mechanical to velocity; mechanical to pressure.

Steam siphon—pressure to velocity.

Water hammer—velocity to pressure.

Filling tank—pressure to velocity to potential.

A fundamental understanding of these principles will make it possible to explain some of the practical aspects of fluid flow.

Factors Determining Fluid Flow

One of the main factors that determines the physical setup of a refinery operating unit is the "rate of flow." Having decided at what rate a unit is to operate, it then becomes a problem of providing the equipment best suited to do the job. Let us first discuss the factors that affect fluid flow in pipes.

Viscosity . . . Viscosity is that property which resists any force that tends to produce flow. This resistance to flow is different for different liquids. For example, if a little gasoline is dropped on a sloping glass it will run very quickly down the glass. A drop of kerosine will also run down the glass, but not quite so quickly. A drop of heavy oil will not run, but will slowly slide down the glass.

A material such as asphalt will hardly slide at all. This resistance to movement is known as viscosity. Since viscosity causes a fluid to resist flow, it affects the performance of our pumps and the pressure drop (ΔP) when pumping through a given pipeline. (ΔP) is pronounced delta P).

Viscosity is important in a refinery because, in addition to affecting performance of the equipment, many products must meet "viscosity" specifications in order to insure proper operation of machines.

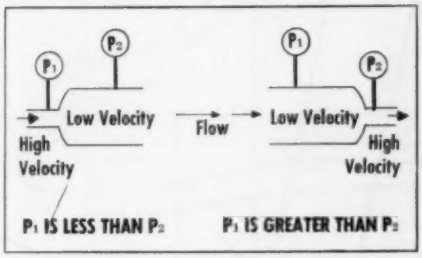
The viscosity of a liquid is determined in a piece of laboratory equipment called a viscosimeter. Fig. 3 shows a viscosimeter tube. This tube rests in a thermostatically controlled bath that holds the oil sample at the required temperature. This temperature is usually set at either 100° F. or 210° F. Therefore, the viscosity reported for a particular sample depends upon the temperature at which the oil was held during the test.

With the sample tube filled and the oil heated to the required temperature, the cork stopper is pulled and the oil allowed to run out of the cylinder. The time in seconds that is required for the oil sample to flow through the small orifice tube is called the viscosity of that particular sample.

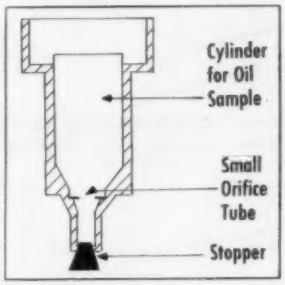
Type of flow . . . In the movement of fluids there are two kinds of flow. Streamline flow is one in which the fluid flows in smooth layers without mixing of the layers. In other words, as the name implies, the flow is in straight unbroken lines. Turbulent flow is one in which there are no set stream lines, and the fluid is continuously mixed. The entire mass is a mixture of eddies and twists that results in a swirling turbulent flow.

Fig. 4 indicates the two types of flow.

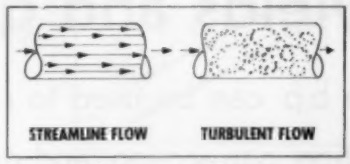
As can be seen from this figure, whether you have streamline or turbulent flow in a pipe depends upon the velocity of flow. The practical application of the effects of streamline and turbulent flow are usually not important to a process man. However, it is a basic principle of flow which is used in designing pipelines.



LOWERING the velocity of a fluid increases the pressure; increasing it reduces the pressure. Fig. 2.

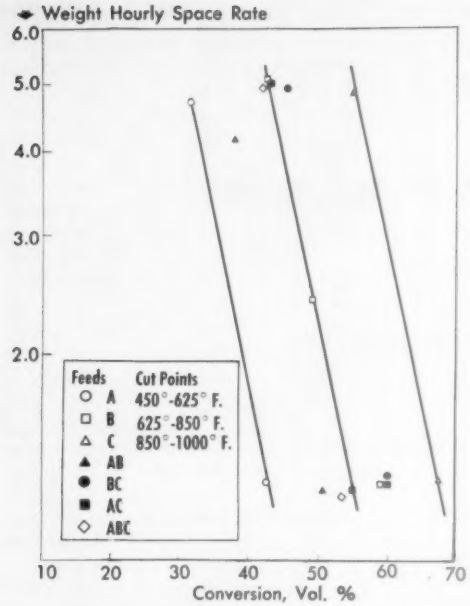


VISCOSIMETER is used to determine viscosity of a liquid. Fig. 3.

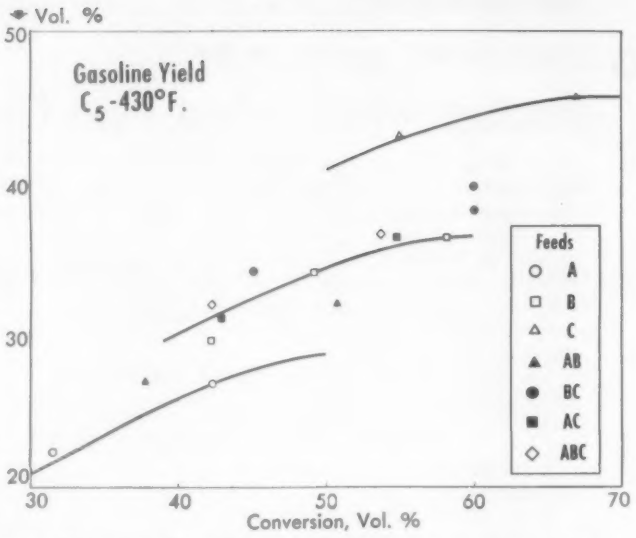


IN STREAMLINE FLOW, left, fluid moves in smooth layers; in turbulent flow, fluid is continuously mixed. Fig. 4.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Oil Co.



SPACE-RATE conversion studies show that feed stocks with high boiling ranges are much more easily cracked. Fig. 1.



GASOLINE-YIELD CONVERSION STUDIES show that gasoline yield increases with conversion and with feed-boiling range. Fig. 2.

How feed boiling range affects cat cracker yields and qualities

Average b.p. can be used to predict gasoline octane, gas composition, conversion, and major products of conversion

BY R. L. FLANDERS, J. G. GIRARD, AND B. D. LAUGHLIN
California Research Corp.
Richmond, Calif.

INVESTIGATORS at California Research Corp. designed experiments aimed at improving the ability to estimate the effects of change in catalytic cracker feed boiling range. The effect of recycle boiling range was also investigated.

These studies show that:

... Average feed boiling point can be used to predict conversion and the major products of conversion, gasoline octanes, and gas composition.

... With data of the type presented here an operator can achieve optimum distribution of available feed components to his cracking units. Thus a balance of feed boiling range with individual plant limitations can maximize product realization for all cracking units.

Paper presented at the fifty-second annual meeting of AIChE, San Francisco, December 1959.

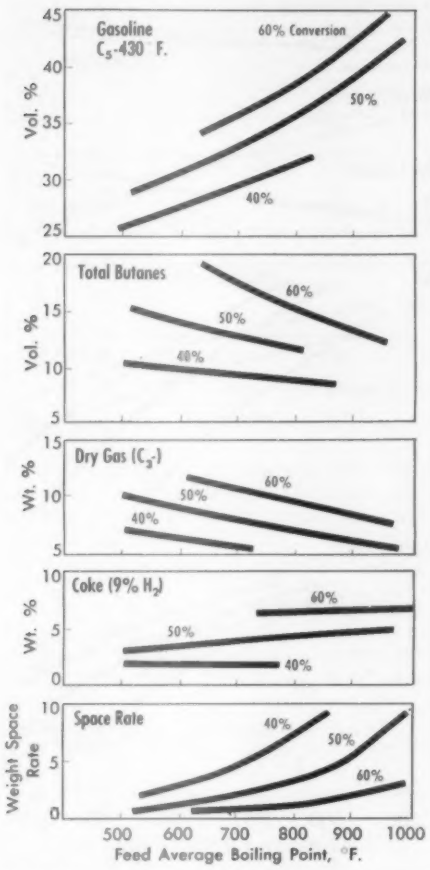
The following show the results of a series of pilot catalytic cracking runs on narrow and broad boiling-range cuts of an Arabian crude.

Feed preparation . . . Three cuts of equal volume were distilled from Arabian crude in laboratory equipment: a light gas oil boiling 450° F. to 625° F., called stock A; an intermediate gas oil boiling 625° F. to 850° F., called stock B; and a heavy vacuum gas oil boiling 850° F. to 1,000° F., called stock C. The final cut, stock C, was prepared with sufficient fractionation and at a low enough cut point to avoid metal contamination.

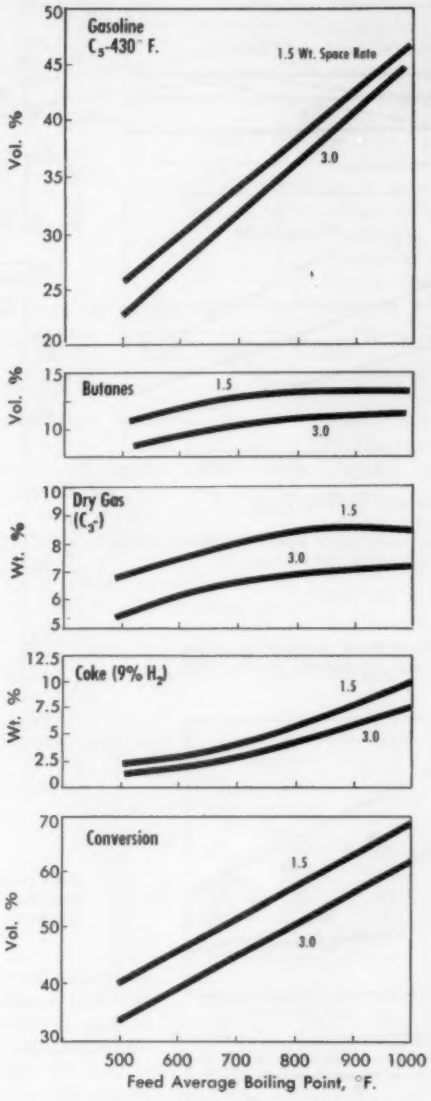
A typical broad cut from Arabian crude was obtained from a commercial plant. This gas oil corresponds roughly to a blend of stocks B and C as prepared in pilot distillation equipment. This broad cut, which we will call stock D, was used in the evaluation of the effect of recycle boiling range. Inspections of these cuts are shown on Table 1.

Pilot equipment . . . The pilot cracking unit was a modification of a Gulf research and development unit described previously by Carpenter, Ackerman, and Rice.[1] A recycle still was added to permit recycle of any portion of the distillation product.

The unit has continuous circulation of catalyst from reactor to regenerator and continuous fractionation of products. Commercial operation can be simulated on the unit; however, certain adjustments on coke yield are



PRODUCT DISTRIBUTION at fixed conversion from catalytic cracking operations. Fig. 3.



PRODUCT DISTRIBUTION at two different space rates show that conversion rises rapidly without increasing feed boiling point. Fig. 4.

required because of superior stripping in the pilot plant.

Operating conditions... All of the runs were made at a reactor temperature of 925° F. Catalyst-to-oil ratio was held constant at 11 to 1 for all runs and is expressed in weight units on a total feed basis. Most of the feed components were cracked at each of two space rates. This gave a reasonable spread in extent of conversion and provided a direct comparison of crackability. Pressure was controlled to 10 psig. throughout all runs. Steam dilution in the reactor, together with nitrogen from various bleed streams, was held constant.

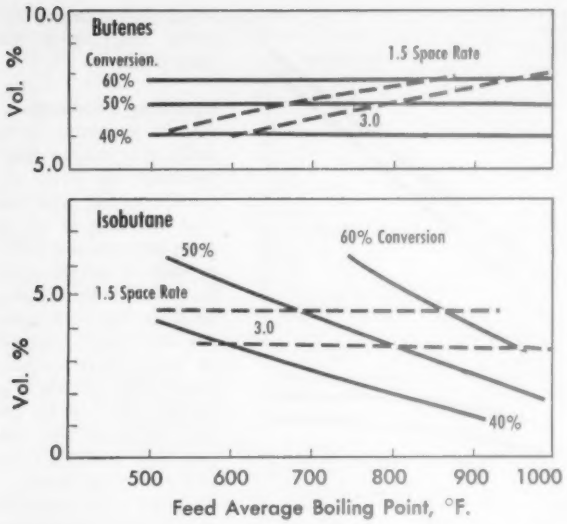
The catalyst was equilibrium synthetic drawn from a plant operating on California gas oil. Metal contamination was moderate. The pilot-plant catalyst charge was changed frequently to eliminate catalyst quality as a variable.

Relative cracking rates. The higher the feed boiling range, the more readily the stock cracked. These results agree with others.[2,3,4,6,7] In Fig. 1, space-rate conversion relationships

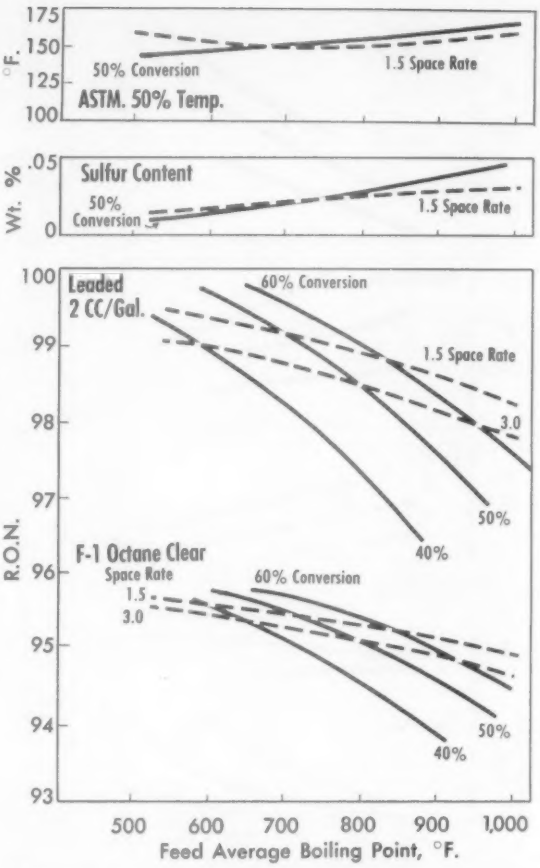
TABLE 1—ARABIAN GAS-OIL FEED INSPECTIONS

Cut identification—	A	B	C	AB	BC	AC	ABC	D
Location in crude, vol. %	34.2-51.8	51.8-71.5	71.5-87.3	34.2-71.5	51.8-87.3	34.2-51.8+ 71.5-87.3	34.2-87.3	
Inspections:								
Gravity, °API	38.5	26.9	19.2	32.2	23.6	28.8	28.4	24.8
Aniline pt., °F.	157	174	190	167	182	172	173	179
Bromine No., g/100g	.....	10	.....	13	14	8	.....	10
Sulfur, wt. %	0.76	2.1	2.7	1.4	2.4	1.8	1.8	2.15
Nitrogen, wt. %	.....	0.07	0.14	0.05	0.06	0.06	.....	0.06
Vis., S.s.U./130° F.	32.9	56.2	416	37.8	108	53.3	53.4	78.8
Pour pt., °F.	−5	+65	+100	+35	+90	+85	+80	+95
Con carbon, wt. %	0.00	0.02	1.7	0.01	0.75	0.86	0.67	0.06
ASTM Dist.,* °F.	D-158	D-1160	D-1160	D-1160	D-1160	D-1160	D-1160	D-1160
I.b.p.	430	576	536	448	600	403	433	459
10%	471	668	881	501	679	488	514	621
30%	493	700	923	562	741	532	608	727
50%	511	732	968	630	829	602	717	808
70%	531	775	1,014	707	914	925	856	904
90%	560	841	1,063 at 83%	797	1,026	1,031	993	998
E.p.	592	930	.....	879	.....	1,067 at 92%	1,072	1,126
Feed average B.P.	523	743	977	639	838	744	738	812
Metals, p.p.m.:								
Copper	0.00	0.05	0.29	.....	.....	.....	.....	<0.07
Nickel	0.00	0.00	0.05	.....	.....	.....	.....	0.00
Vanadium	0.00	0.00	0.45	.....	.....	.....	.....	0.22

*D-1160 distillations adjusted to 760 mm.

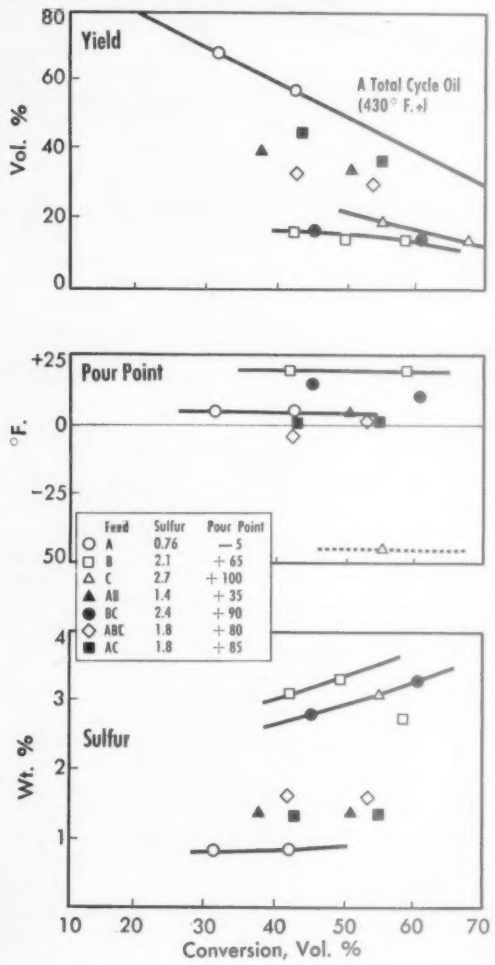


ISOBUTANE YIELD decreases as boiling point increases while yields of butenes remain about the same. Fig. 5.



GASOLINE OCTANE NUMBER decreases with increasing feed-boiling point while other properties remain relatively constant. Fig. 6.

CYCLE-OIL PROPERTIES reflect feed properties since much of this stock is merely unreacted fresh feed. Fig. 7.



are shown for each of the feed stocks. Conversion is defined as 100 minus the per cent of product which boils above 430° F. and ignores the small amount of gasoline overlap in stock A. Note that no conversion credit is taken for product boiling between 430° F. and the feed i.b.p.

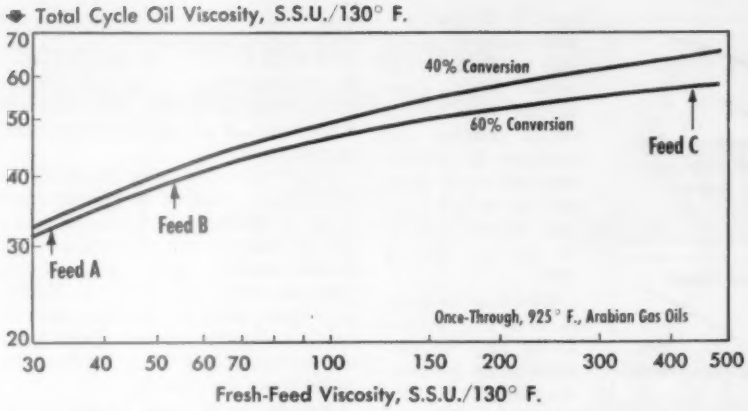
Blends tend to crack at rates intermediate to those of the components from which the blends were made. Stock B, a narrow boiling cut; stock ABC, a broad cut; and stock AC, a feed composed of only light and heavy-boiling material called a dumbbell feed; all have roughly the same average boiling point. Note that these three feeds crack at approximately the same rate.

Product distribution . . . Product yields and qualities were measured for each of the three feed stocks and from all blends of these stocks. These yields were then plotted to show their relationship to conversion level. A typical result, Fig. 2, shows gasoline yield as a function of conversion for each of the several feed stocks.

Notice that stock A, the light gas oil, produces less gasoline than stock B at a given conversion. Feed AB is intermediate between A and B. Stock C, the highest-boiling stock, cracks the most readily and produces the most gasoline at a given conversion. This fact is confirmed by most investigators.[2 3 4 6 7]

Stocks B, AC, and ABC have roughly the same average boiling point. Fig. 1 shows that these three stocks are equally refractory. Fig. 2 shows that, at a given conversion, the yield of gasoline from these three feeds is equivalent. A similar relationship can be shown for coke, gas, and butanes, as well as gasoline yields.

Data of the type shown in Fig. 2 were crossplotted to show product distribution as a function of average



CYCLE-OIL VISCOSITY is much less than that of the feed. Fig. 8.

feed boiling point. Parameters were conversion and space rate. (Average feed boiling point is the arithmetic average of the 10%, 30%, 50%, 70%, and 90% temperature points of an ASTM D 1160 distillation.)

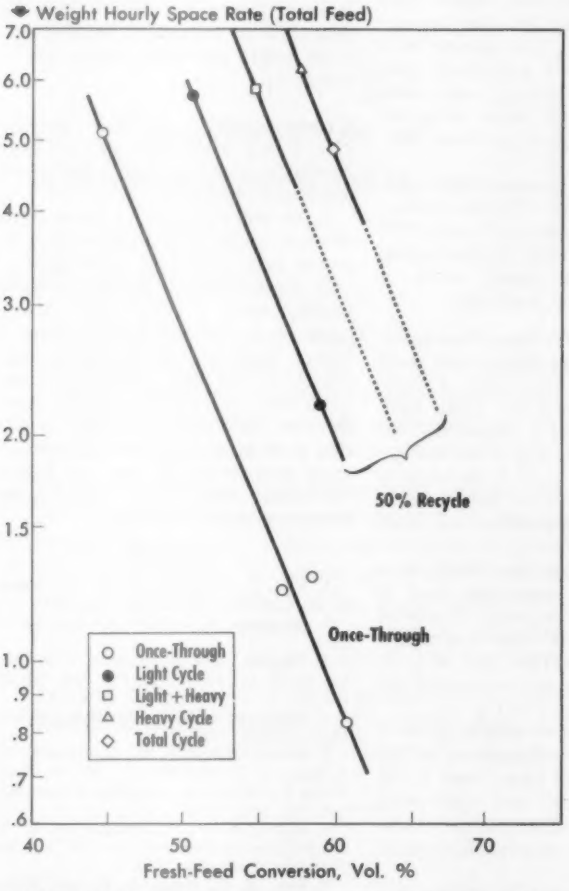
Fig. 3 shows product distribution at fixed conversion. Conversion is held constant by adjustments to space rate. Heavy feeds crack more readily than light feeds. At constant conversion, then, as feed becomes heavier, the feed rate is increased. This is shown in the space-rate plot at the bottom of Fig. 3.

In the upper portion of this chart, basic products of the cracking reaction are related to the feed average boiling point. Note that gas and butanes yields decline, whereas, coke and gasoline yields increase at fixed conversion with increasing average feed boiling point. This is in agreement with Murphree.[2]

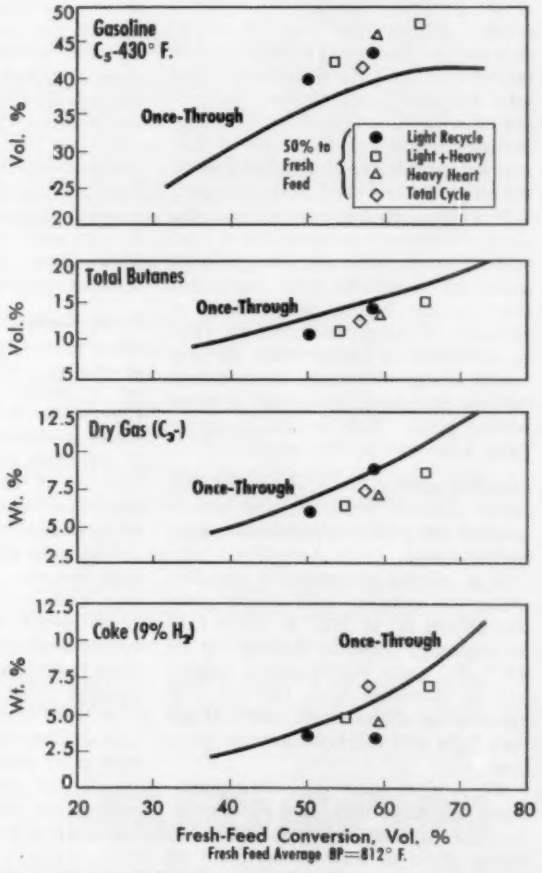
Though it is not shown in the plot, yields of C_2 and lighter are unchanged as feed becomes heavier at constant conversion. Hence, of the light gases, it is primarily the propane yields which reflect feed boiling range.

On Fig. 4 product distribution is shown at two different space rates. Conversion is rising rapidly with increasing feed boiling point. Not all products increase with conversion, however. Gas and butane yields tend to level off from stocks with high-average feed boiling point even though conversion is rising.

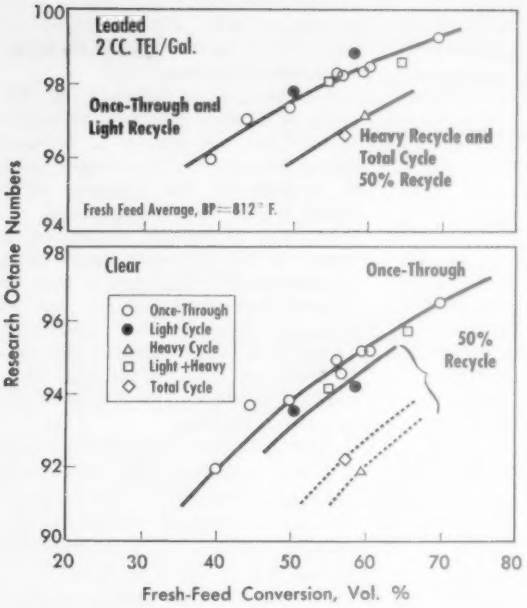
This particular form of expressing the data is probably the most useful to the operator. As the refiner changes the operation of his crude unit, changes occur in either the front end or tail end of his cracker feed. Unless he makes some change in cracking conditions, product-distribution changes will follow the lines shown on this chart.



RECYCLE REACTIVITY increases as recycle becomes higher boiling. Fig. 9.



PRODUCT SELECTIVITY for recycle operation shows that at given conversion all types of recycle tend to make more gasoline and less gas and butanes. Fig. 10.



GASOLINE OCTANES increase with increasing conversion, and recycle of light oil produces higher-octane gasoline. Fig. 11.

Gas unsaturation . . . Gas composition is of interest because the catalytic cracker provides the feed for alkylation and polymerization units in many refineries. The yield of isobutane and total butenes from fresh feed are presented as a function of feed average boiling point in Fig. 5. Yields of normal butane are not shown because of the relatively low yield of this product.

Note that at fixed conversion the yield of butenes is independent of feed boiling range, whereas, the yield of isobutane decreases with increasing feed average boiling point. Also, at constant cracking conditions the yield of isobutane is independent of feed boiling range, whereas, the yield of butenes increases with feed average boiling point. This is also in agreement with moving-bed operation.[8]

Gasoline quality . . . It was found that sulfur content, volatility, and octane number are greatly dependent on feed boiling range.

It is normal procedure in our laboratory to examine both a light gasoline boiling up to 250° F. and a full-boiling-range gasoline boiling up to 430° F. Only light-gasoline quality will be discussed here, but the conclusions are directionally identical for both light and full-boiling-range gasoline.

Fig. 6 gives selected gasoline inspections and shows them as a function of feed average boiling point. Note a strong effect of feed boiling point on gasoline octane number. Others show this effect is not so much related to distillation as to other feed inspections.[2,5] Higher-octane-number stocks are produced with lighter feeds. Conversion also affects octane number. An increase in conversion will result in an increase in both clear and leaded octanes as will be shown later.

Gasoline volatility is inversely related to the 50% temperature of the gasoline. Gasoline 50% temperature is shown at the top of Fig. 6. At first glance the variation in gasoline 50% temperature with feed boiling range may not appear significant.

To the refiner who has to meet rigid product specifications, however, the 25° F. swings in gasoline 50% temperature shown here are most important. At fixed conversion an increase in feed average boiling point results in a less-volatile gasoline. At fixed cracking conditions, there is a somewhat lesser effect of feed boiling range on gasoline volatility.

Gasoline sulfur content is low for a 250° F. e.p. stock. Trends shown, however, are real and apply to a 430° F. e.p. stock as well. Higher-boiling feeds have more sulfur which is reflected in gasoline produced.

Cycle stocks . . . As would be expected, cycle-oil properties reflect feed properties. After all, much of cycle oil is merely unreacted fresh feed. Light-cycle-oil (l.c.o.) properties and yields are shown in Fig. 7. At the top of the chart l.c.o. yield is shown as a function of conversion. Below, some important l.c.o. inspections are related to conversion.

The yield of l.c.o. from stock A is high because all unreacted feed is l.c.o. boiling-range material. Yields of l.c.o. from B and C represent mostly synthetic material. The yield of l.c.o. from these heavier stocks parallels the gasoline yields shown in Fig. 2.

A small amount of overlap in B of l.c.o. boiling-range oil accounts for the high pour point of l.c.o. from B. A comparison of feed and cycle-stock pour points shows that catalytic cracking is not a good pour-breaking process.

However, the catalytic cracker is a good viscosity breaker. This is shown in Fig. 8. For a wide variety of fresh-feed viscosities, a small range of cycle-stock viscosities result.

Recycle reactivity . . . In these recycle considerations, yields still refer to fresh feed and are not concerned with reactor feed.

Fig. 9 shows relative reactivity of four types of internal recycle produced from stock D, a broad-range virgin gas oil. Recycle rate is fixed at 50% of the fresh-feed rate. Space rate in this plot refers to total feed. Hence, at 3 space rate, for example, recycle (at fixed catalyst holdup) means backing out fresh feed barrel for barrel to make room for recycle.

Results show that reactivity increases as recycle becomes higher boiling. This is in general agreement with Hengstebeck,[4] who based his comparison on once-through cycle oils.

Product distribution . . . Product selectivity for recycle operation compared to once-through operation is shown in Fig. 10. Note that, at a given conversion, all types of recycle tend to make more gasoline and less gas and butanes than does once-through operation. When total cycle is recycled, coke make is greater for recycle than for once-through operation. Distillate recycle stocks are nearly equivalent in selectivity.

Gasoline quality . . . Fig. 11 presents 430° F.-e.p. gasoline octanes obtained in recycle cracking of stock D. Several important observations are:

1. In recycle cracking, as in once-through cracking, gasoline octanes increase with increasing conversion.

2. Light-cycle-oil recycle produces higher-octane gasoline than heavy-cycle oil; in fact, the leaded octane is higher than that from once-through operation. This was confirmed recently in other pilot studies where once-through cycle oils were given a second pass as a fresh feed. Results of these tests indicated that the higher the boiling range of the cycle oil, the lower the gasoline octane.

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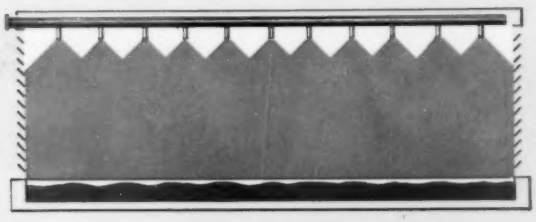

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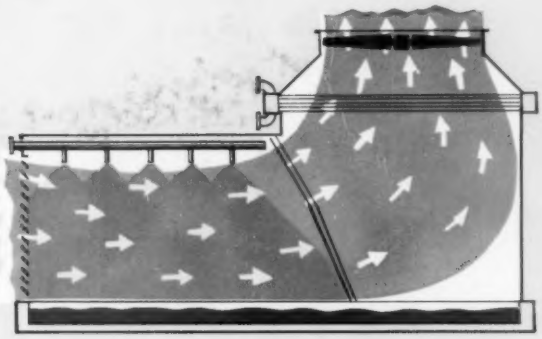

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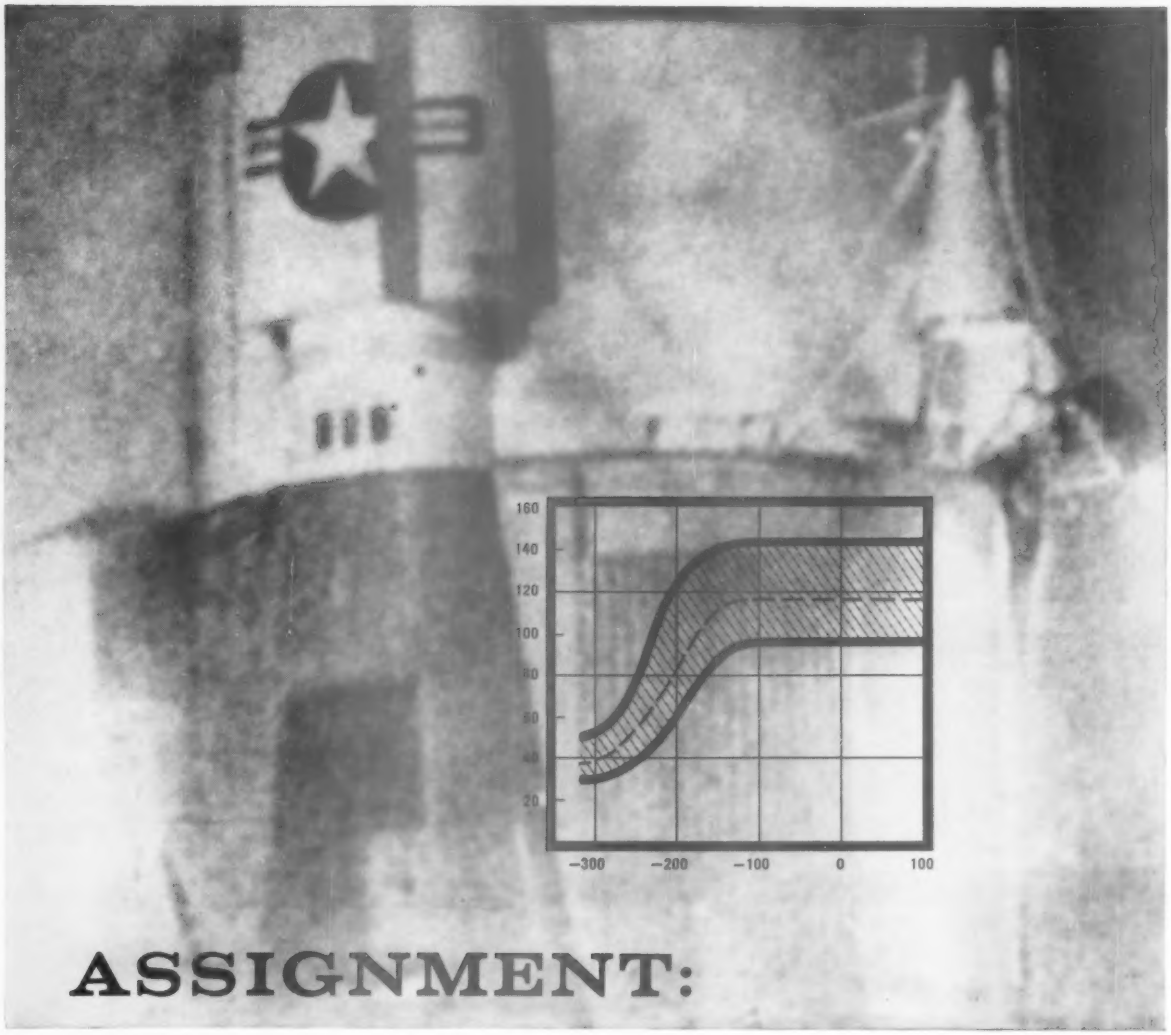

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Operating costs—viscosity breaking

BY W. L. NELSON
Technical Editor and Petroleum Consultant

ONCE-THROUGH viscosity breaking as a separate cracking operation is considered here. Although viscosity breaking is similar to thermal cracking, the cost of viscosity breaking is much less because expensive recycling is not involved; very little gasoline is produced (a low heat of decomposition); and because relatively small amounts of material are handled (pumped). Table 1 indicates the basic operating cost elements applied to a 10,000-bbl. per day plant. Fig. 1 shows the general effect of capacity on operating cost. The scant literature indicates 1956 costs of 10 to 13 cents per barrel.

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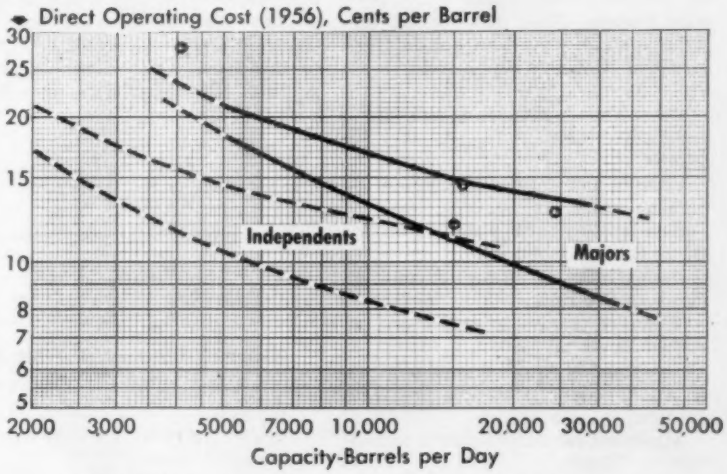

OPERATING COST (1956) of viscosity-breaking plants. Fig. 1.

TABLE 1—ELEMENTS OF OPERATING COSTS (VISCOSITY BREAKING).

Element	Unit (somewhat standard)	1956 Unit cost	Cents per bbl. (10,000 B/D plant)	See process costimating No.
Labor—supervision	0.3-1 men/8 hr. shift*	$3.85/hr.	0.28-0.92*	
Labor—operating	2.2-5 men/8 hr. shift*	$3.12/hr.†	1.65-3.74*	26, 28, 41
Maintenance	3.5-5%/yr. of replacement cost	$120-$180/daily bbl.‡	1.15-2.46	29
Fuel	125,000-210,000 B.t.u./bbl.§	25-40 ct./M.M. B.t.u.	3.1 -8.4	3, 4, 6
Power	0.0024-0.024 b.hp.-hr.¶	0.9 ct./hp.-hr.	0.05-(0.52)	13, 14, 21-23
Steam	14-29 lb./bbl.¶	45-60 ct./M. lb.	0.63-0.74¶	17, 18
Water cooling	60,000-100,000 B.t.u./bbl.‖	1.7 ct./M. gal.‖	0.41-0.68	15, 16
Chemicals	(lime, inhibitors, etc.)	.....	0 -0.10	
Compression	(gas handling included in gas plant costs)		.....	
	TOTAL DIRECT COST	(Probable extremes)	9.1 -14.2	
Obsolescence	1%/yr. of replacement	$120-$180/daily bbl.	0.33- 0.49	
Insurance and taxes	2%/yr. of replacement	$120-$180/daily bbl.	0.66- 0.99	
Interest or dividends	4%/yr. of replacement	$120-$180/daily bbl.	1.31- 1.98	
Laboratory overhead	0.1-0.3 men/shift*	$3.12 per hr.†	0.07- 0.22	
	Other possible indirect costs		.....	
			2.5 - 3.3	

*Lowest figure is considered as average for small or independent operators and largest figure for major refiners or government-operated plants.
†Average U. S. wages plus 27% for all burdens.
‡See Costimating No. 28, April 15, 1957, for a 10,000-bbl. per day plant. Viscosity-breaking plants cost about 60% as much as cracking plants.
§Heat generated, the heat absorbed is less by the efficiency of the heater.
¶High power figure represents use of no steam pumps. See steam cost next below, if feed and bottoms pumps are steam driven. Efficiency of electrical pump 70% except feed and bottoms pumps only 45%.
‖250,000 B.t.u. per 1,000 gal. at a rise of 30° F.

21. How to obtain relative permeabilities and relative permeability ratios

... from laboratory unsteady-state displacement data. A sandstone core is used and the results are compared with steady-state data

BY E. T. GUERRERO
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and
F. M. STEWART
Petroleum Engineer, Continental Illinois National Bank & Trust Co., Chicago

GIVEN: A sandstone core saturated with water (minimum interstitial) and oil was used in a water-displacement experiment. The same core was later cleaned and used to obtain water and oil relative permeabilities by steady-state method. Basic data for the unsteady-state displacement test data are given in Columns 1, 2, and 3 of Table 2.

Other known data are as follows:

Absolute permeability, $k = 2.68$ darcies.

Cross-sectional area of core, $A = 5.03$ sq. cm.

Constant rate of water injection, $Q_t = 8.10$ cc./min.

Permeability to water at end of flood = 670 md.

Water saturation at outlet end at end of flood = 69.0%.

Permeability to oil at minimum interstitial - water saturation = 2.68 darcies.

Minimum interstitial - water saturation = 12.6%.

Viscosity of oil at mean test conditions, $\mu_o = 45.7$ cp.

Viscosity of water at mean test conditions, $\mu_w = 0.90$ cp.

Length of core, $L = 15.7$ cm.

Steady-state test data are given in Columns 1, 2, and 3 of Table 1.

FIND: Variation of relative permeability to oil, relative permeability to water, and water-oil relative-permeability ratios with water saturation by both steady and unsteady-state methods.

METHOD OF SOLUTION: Actual calculation of effective permeabilities from steady-state data is not included in this problem because this was shown in a previous problem.[2] (Part 8 of this series, OGJ, April 20, 1959, p. 120). Equations defining relative permeabilities are:

$$k_{ro} = k_o/k \quad (1)$$

$$k_{rw} = k_w/k \quad (2)$$

For unsteady-state conditions:

$$f_{o2} = \frac{d_{sw}}{d_{wi}} \approx \frac{\Delta S_w}{\Delta W_i} \quad (3)$$

(Columns 4 through 6, Table 2)

$$k_{ro} = \frac{f_o}{d\,(1/W_i\,I_r)/d\,(1/W_i)} \approx f_o \frac{\Delta(1/W_i)}{\Delta(1/W_i\,I_r)} \quad (4)$$

(Columns 7 through 13, Table 2)

$$\frac{1}{I_r} = \frac{v_s/\Delta p_s}{v_t/\Delta p} = \frac{k/L\,\mu_o}{14.7Q_t/60A\,\Delta p} = \frac{k\,A\,\Delta p}{Q_t\,L\,\mu_o}\,\frac{60}{14.7} \quad (5)$$

TABLE 1—RELATIVE-PERMEABILITY RATIOS FROM STEADY-STATE DATA

Run No.	(1) k_o, md.	(2) k_w, md.	(3) S_w, %	(4) k_{ro}	(5) k_{rw}	(6) k_w/k_o
1	2,680	0	12.6	1.00	0	0
2	2,360	21.4	20.0	0.881	0.008	0.00908
3	2,140	34.8	24.0	0.799	0.013	0.0163
4	1,770	48.2	30.0	0.660	0.018	0.0273
5	1,610	53.6	32.5	0.601	0.020	0.0333
6	1,110	75.0	40.0	0.414	0.028	0.0676
7	697	142	50.0	0.260	0.053	0.204
8	536	214	54.5	0.200	0.080	0.400
9	375	335	60.0	0.140	0.125	0.893
10	255	536	66.0	0.095	0.200	2.11
11	0	844	74.0	0	0.315	∞

Absolute permeability, $k = 2.68$ darcies.

$$v_s/\Delta p_s = \frac{k}{L\,\mu_o} \quad (6)$$

$$v_t/\Delta p = \frac{14.7\,Q_t}{60A\,\Delta p} \quad (7)$$

$$S_{w2} = S_w \text{ avg.} - W_i \text{ avg. } f_{o2} \quad (8)$$

(Columns 14 through 17, Table 2)

$$k_{rw} = k_{ro}\,(1 - f_o/f_o)\,\mu_w/\mu_o \quad (9)$$

(Columns 18 through 21, Table 2)

$$k_{rw}/k_{ro} = k_w/k_o \quad (10)$$

(Columns 22 through 24, Table 2)

Where:

Q_t was defined with the data.

f_o and f_{o2} are fractions of oil in total flow at any point and at the outlet end, respectively.

S_w, S_{w2}, S_w avg. are water saturations at any point, at the outlet end, and in an interval of interest, respectively.

I_r is the relative injectivity or the ratio of the intake capacity at any point in a flood to the intake capacity of the system at the initiation of the flood.

v_t and v_s are average velocities in the pores, cm./second, at any point and at the initiation of the flood, respectively.

p and p_s are pressure drops across the core, psi., at any time and at the initiation of the flood, respectively.

All others are standard AIME symbols (Journal of Petroleum Technology, October 1956).

SOLUTION:

The results of the steady-state method are shown in Table 1, Columns 4, 5, and 6. As an example calculation take a water saturation of 20.0% where $k_o = 2{,}360$ md. and $k_w = 21.4$ md.

$$k_{ro} = \frac{(2{,}360)}{(2.68)\,(1{,}000)} = 0.881$$

TABLE 2—BASIC DATA AND CALCULATION OF RELATIVE PERMEABILITIES AND RELATIVE-PERMEABILITY RATIOS FROM THE UNSTEADY-STATE WATER-DISPLACEMENT TESTS

Run No.	(1) W_i PV	(2) S_w fraction	(3) Δp psi.	(4) ΔS_w $(2)_n - (2)_{n-1}$	(5) ΔW_i $(1)_n - (1)_{n-1}$	(6) $\Delta S_w/\Delta W_i = f_{o2}$ (4) ÷ (5)	(7) $1/I_r$ $\Delta p \div 105.63$	(8) $1/W_i$ $1 \div (1)$
1	0.2	0.325	61.5	.....	.....	.....	0.5822	5.0000
2	0.3	0.398	50.0	0.073	0.1	0.73	0.4734	3.3333
3	0.4	0.466	41.3	0.068	0.1	0.68	0.3910	2.5000
4	0.5	0.504	34.3	0.038	0.1	0.38	0.3247	2.0000
5	0.6	0.530	29.3	0.026	0.1	0.26	0.2774	1.6667
6	0.7	0.552	25.2	0.022	0.1	0.22	0.2386	1.4286
7	0.8	0.569	22.2	0.017	0.1	0.17	0.2102	1.2500
8	0.9	0.581	20.0	0.012	0.1	0.12	0.1893	1.1111
9	1.0	0.590	18.7	0.009	0.1	0.09	0.1770	1.0000
10	1.2	0.602	16.7	0.012	0.2	0.06	0.1581	0.8333
11	1.4	0.614	15.2	0.012	0.2	0.06	0.1439	0.7143
12	1.6	0.624	14.5	0.010	0.2	0.05	0.1373	0.6250
13	1.8	0.633	13.8	0.009	0.2	0.045	0.1306	0.5556
14	2.0	0.642	13.1	0.009	0.2	0.045	0.1240	0.5000
15	2.2	0.648	12.5	0.006	0.2	0.03	0.1183	0.4545
16	2.4	0.655	12.1	0.007	0.2	0.035	0.1146	0.4167
17	2.6	0.661	11.4	0.006	0.2	0.03	0.1079	0.3846
18	2.8	0.666	11.0	0.005	0.2	0.025	0.1041	0.3571
19	3.0	0.671	10.6	0.005	0.2	0.025	0.1004	0.3333
20	3.4	0.678	10.0	0.007	0.4	0.018	0.0947	0.2941
21	3.8	0.685	9.5	0.007	0.4	0.018	0.0899	0.2632
22	4.2	0.692	8.8	0.007	0.4	0.018	0.0833	0.2381

TABLE 2 (Continued)

Run No.	(9) $1/W_i I_r$ (7) × (8)	(10) $\Delta(1/W_i)$ $(8)_n - (8)_{n-1}$	(11) $\Delta(1/W_i I_r)$ $(9)_n - (9)_{n-1}$	(12) $\frac{\Delta(1/W_i)}{\Delta(1/W_i I_r)}$ (10) ÷ (11)	(13) k_{ro} (6) × (12)	(14) S_w avg. $\frac{(2)_n + (2)_{n-1}}{2}$	(15) W_i avg. $\frac{(1)_n + (1)_{n-1}}{2}$	(16) $f_o W_i$ avg. (6) × (15)
1	2.9110	.....	.....	.....	.....	.....	.....	.....
2	1.5780	1.6667	1.3330	1.2503	0.9127	0.3615	0.25	0.1825
3	0.9775	0.8333	0.6005	1.3877	0.9436	0.4320	0.35	0.2380
4	0.6494	0.5000	0.3281	1.5239	0.5791	0.4850	0.45	0.1710
21	0.0237	0.0309	0.0042	7.3571	0.1324	0.6815	3.60	0.0648
22	0.0198	0.0251	0.0039	6.4359	0.1158	0.6885	4.00	0.0720

TABLE 2 (Continued)

Run No.	(17) S_{w2} (14) − (16)	(18) $f_w = \frac{(1 - f_o)}{1 - (6)}$	(19) f_w/f_o (18) ÷ (6)	(20) $f_w/f_o \times k_{ro}$ (19) × (13)	(21) $k_{rw} = f_w/f_o \times k_{ro} \times \mu_w/\mu_o$ (20) × μ_w/μ_o	(22) $k_{rw}/k_{ro} = k_w/k_o$ (21) ÷ (13)	(23) k_o, md.	(24) k_w, md.
1	.....	.....	.....	.....	.....	.....	.....	.....
2	0.1790	0.270	0.3699	0.3376	0.0066	0.0072	2,446	17.7
3	0.1940	0.320	0.4706	0.4441	0.0087	0.0092	2,529	23.3
4	0.3140	0.620	1.6316	0.9449	0.0186	0.0321	1,552	49.8
21	0.6167	0.982	54.5556	7.2232	0.1422	1.0740	355	381
22	0.6165	0.982	54.5556	6.3175	0.1244	1.0743	310	333

Note: Columns 9 to 24 abridged.

$$k_{rw} = \frac{21.4}{(2.68)\,(1{,}000)} = 0.008$$

$$\frac{k_w}{k_o} = \frac{k_{rw}}{k_{ro}} = \frac{0.008}{0.881} = 0.00908$$

The calculating steps and results by the unsteady-state method are shown in Columns 4 through 24 of Table 2. As an example calculation take the data for a water saturation of 39.8%

where $W_i = 0.3$ and $\Delta p = 50$ psi.

$$f_o = \frac{0.398 - 0.325}{0.3 - 0.2} = 0.73$$

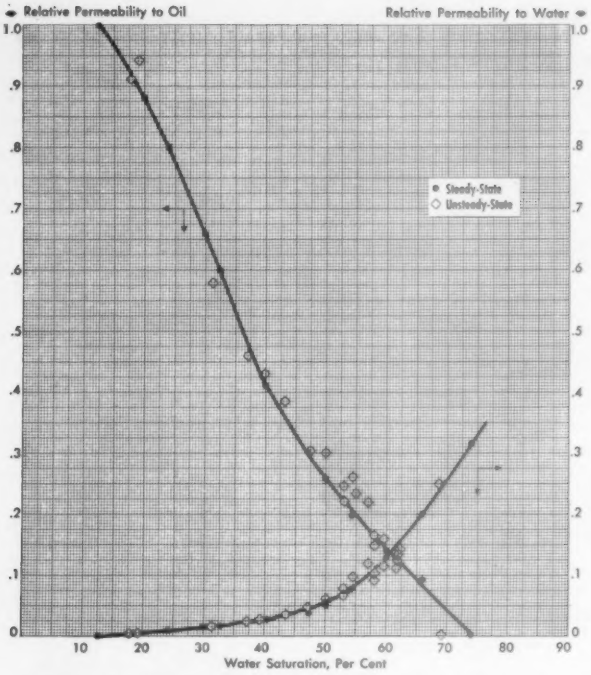
$$\frac{I}{I_r} = \frac{(2.68)\,(5.03)\,(\Delta p)\,(60)}{(8.10)\,(15.7)\,(45.7)\,(14.7)}$$

$$= \frac{\Delta p}{105.63} = \frac{50.0}{105.63} = 0.4734$$

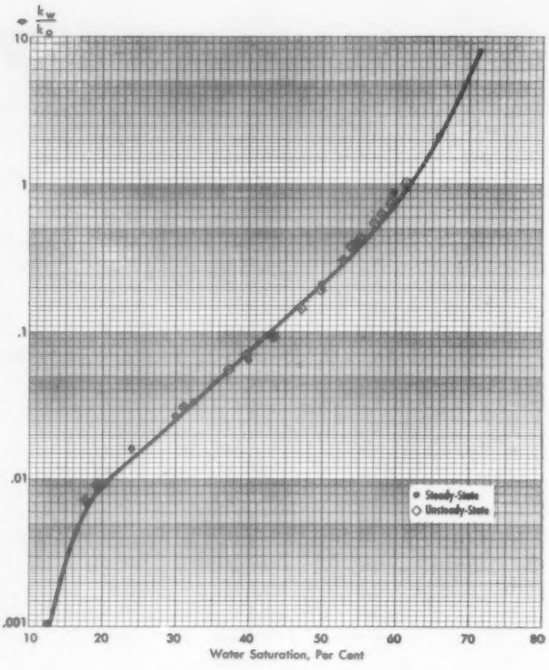
$$k_{ro} = (0.73)\frac{(5.0000 - 3.3333)}{(2.9110 - 1.5780)}$$

$$= 0.9127$$

Note that numerical differentiation has been used in the solution of this problem. Columns 14 and 15 show average values of S_w and W_i corresponding to the midpoint of the interval involved.



OIL-AND-WATER relative-permeability curves. These show the fairly close agreement btween the two methods of calculation. Fig. 1.



PERMEABILITY RATIO CURVE for the same data as shown in Fig. 1. This curve emphasizes the small differences in the two calculation methods. Fig. 2.

Thus:

$$W_i \text{ avg.} = \frac{0.2 + 0.3}{2} = 0.25$$

$$S_w \text{ avg.} = \frac{0.325 + 0.398}{2} = 0.3615$$

and

$$S_{w2} = 0.3615 - (0.25)\,(0.73) = 0.1790$$

$$k_{rw} = 0.9127 \times \frac{1 - 0.73}{0.73} \times \frac{0.90}{45.7} = 0.0066$$

$$\frac{k_{rw}}{k_{ro}} = \frac{k_w}{k_o} = \frac{0.0066}{0.9127} = 0.0072$$

$$k_w = (0.0066)\,(2.68) = 0.0177 \text{ darcies} = 177 \text{ md.}$$

$$k_o = (0.9127)\,(2.68) = 2.446 \text{ darcies} = 2{,}446 \text{ md.}$$

DISCUSSION: This problem illustrates the use of one of the latest extended applications of the original Buckley and Leverett Frontal Advance theory.[5] For a long time this theory was used as extended by Welge (examples of which are Part 19[6] and Part 20[7] of this series). Welge's extension[3] made it possible to use this theory in the laboratory determination of permeability ratios, k_g/k_o and k_w/k_o. Johnson et al.[1] added to Welge's work in order to make possible the determination of relative and effective permeabilities (in addition to permeability ratios) from laboratory displacement tests. Although their method is applied in this problem to water-displacement test data, it can be used to calculate equivalent values from gas displacement tests. The assumptions necessary for the validity of the theory were discussed in Part 19.[6]

Equations 3, 8, and 9 were previously discussed and used.[6 7] Equations 4 and 5 were developed by Johnson et al.[1] using the frontal-advance equation and Rapaport's[4] relative-injectivity function. The obtainment of values for the derivative terms in Equations 3 and 4 can be accomplished by either graphical or numerical methods. The numerical method used in this case is simple, sufficiently accurate, and easy to perform. It assumes that a graph of the factors involved (S_w vs. W_i and $1/W_i$ vs. $1/W_i I_r$) is a straight line between any two successive data points.

By comparison, the calculations involved in the unsteady-state method are considerably more involved than for the steady-state approach. However, the basic data for the former method can be obtained in a matter of a few hours where the latter may require days or even weeks. The disadvantage of complex calculations becomes minor when the use of an electronic computer is available.

Fig. 1 shows oil and water relative permeabilities as determined from steady and unsteady-state tests. Note that the two methods give comparable results. Fig. 2 shows the same data plotted in ratio form. Here a typical relative-permeability ratio graph is obtained with the data from the two methods again agreeing quite well. The graph has been extended to form the typical S-curve based on knowledge of the fluid saturations at which each of the fluids begins and stops to flow.

The unsteady-state method of obtaining flow data illustrated by this problem is more practical than the Welge technique[3 6 7] since it gives effective permeabilities in addition to permeability ratios. This is true despite the fact that the two methods use similar displacement data.

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2. Guerrero, E. T., and Stewart, F. M., "Measurement of Effective Permeability," The Oil and Gas Journal, April 20, 1959, Vol. 57, No. 17.

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5. Buckley, S. E., and Leverett, M. C., "Mechanism of Fluid Displacement in Sands," AIME Tech. Pub. 1337.

6. Guerrero, E. T., and Stewart, F. M., Part 19, The Oil and Gas Journal, Feb. 1, 1960.

7. Guerrero, E. T., and Stewart, F. M., Part 20, The Oil and Gas Journal, Feb. 22, 1960.

See why ALCOA ALUMINUM makes a good design habit

Requirement: A low-cost material able to stand up at temperatures below −190°F

Key to good design: Specify Alcoa Aluminum for piping and equipment in the cryogenic range

When process temperatures reach levels below 0°F, aluminum becomes easily the most satisfactory metal for process equipment and piping. Many materials undergo pronounced changes in physical structure at these temperatures. In most cases, the result is substantial deterioration in the material's serviceability. The reverse is true with aluminum, however.

Aluminum alloys actually display significant improvement in major mechanical properties as operating temperatures drop past 0°F to −300°F and below. For instance, tensile, shear and fatigue strengths of aluminum alloys increase with a decline in temperature.

Operating experience in actual applications has proved the stamina of aluminum in such varied cryogenic applications as these: tonnage oxygen production . . . low temperature recovery of hydrogen from refinery gases . . . methane liquid action, storage and transportation . . . air enrichment for steelmaking. You will find a number of aluminum uses in these and other applications described on the following pages.

One other fact deserves major consideration in evaluating the cryogenic applications of aluminum. It is the surprisingly low initial cost of the light metal. In most instances, aluminum has proved to be far and away the most economical material able to serve satisfactorily in a wide variety of cryogenic operations.

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Aluminum's tensile and yield strengths go up

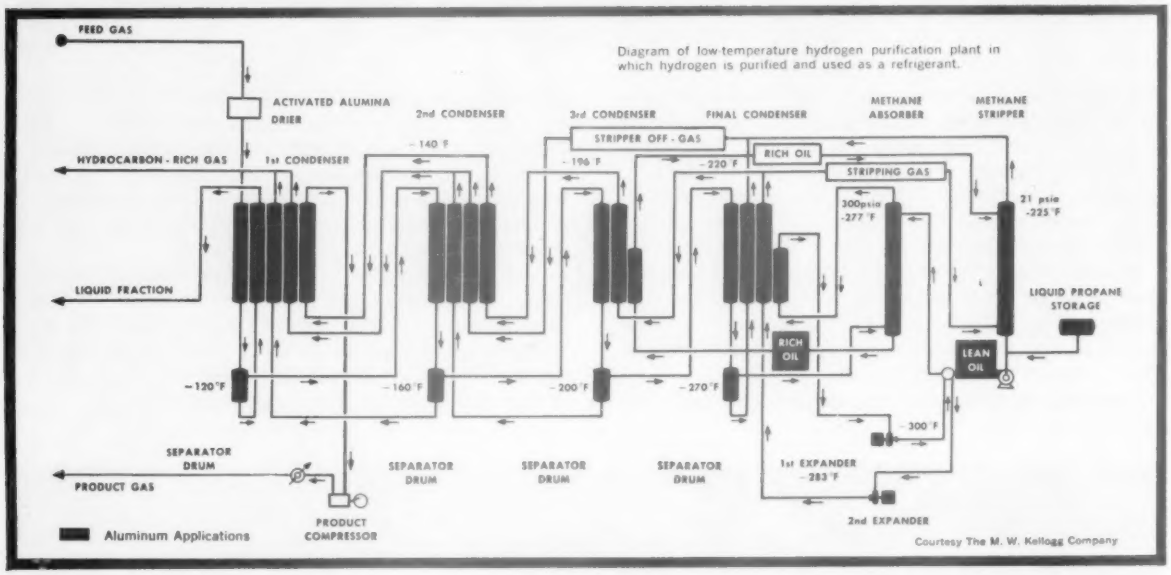


Diagram of low-temperature hydrogen purification plant in which hydrogen is purified and used as a refrigerant.

Courtesy The M. W. Kellogg Company

Because aluminum shows no embrittlement at low temperatures, it enjoys wide use in hydrogen purification plants such as the one shown above.

Aluminum has proved extremely effective for transport piping and tankage in the handling and storage of liquid methane. It is also being used in insulated cargo tanks aboard ship for overseas transport of liquid methane.

Photo courtesy Constock International Methane, Ltd.

This low pressure air separation tower is typical of aluminum equipment now finding broad use in cryogenic operations in the petrochemical field.

Photo courtesy Project Fabrication Corp.

See why ALCOA ALUMINUM makes a good design habit

as the temperature goes down

The light weight of aluminum, added to its low temperature performance, makes for easy, effective handling and storage of liquid nitrogen in this 600-liter container fabricated of Alcoa Aluminum Alloy 5154.

In the chart below, you see results of tensile tests on various aluminum alloys at temperatures ranging from 75°F to −423°F. Note that at −423°F tensile strengths average 35-50 per cent higher than at room temperature, yield strengths 15-25 per cent higher. Temperature drop also brings about increases in elongation. And you will notice that there is no undesirable loss in reduction-of-area.

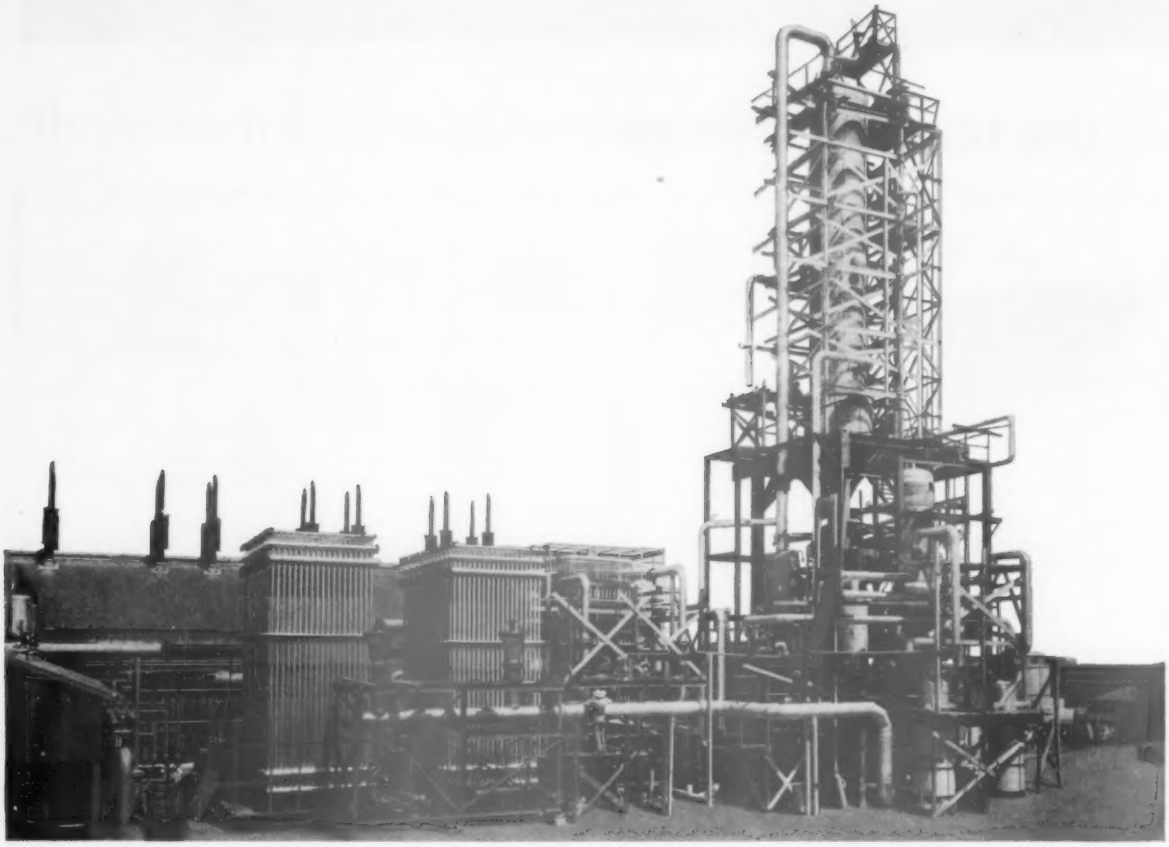
Here, you see evidence of the outstanding low temperature mechanical properties which, coupled with low cost, make aluminum synonymous with efficient, economical design for cryogenic equipment.

Results of Tensile Tests of Some Aluminum Alloys at Subzero Temperatures

Temp., °F	Alloy and Temper	Tensile Strength, psi	Yield Strength,* psi	Elong. in 4D, %	Red. of Area, %	Alloy and Temper	Tensile Strength, psi	Yield Strength,* psi	Elong. in 4D, %	Red. of Area, %	Alloy and Temper	Tensile Strength, psi	Yield Strength,* psi	Elong. in 4D, %	Red. of Area, %
75	3003-0	15,600	6,000	43.0	81	5154-0	35,200	17,100	28.8	66	5356-0	42,100	19,200	30.0	54
— 18		15,600	6,100	44.0	81		35,400	16,600	31.5	72		42,800	19,400	31.5	65
—112		19,000	7,300	45.0	80		36,500	17,200	35.0	73		43,300	19,700	33.5	66
—320		32,300	8,600	48.8	76		51,200	19,600	41.6	60		61,300	22,200	42.5	48
75	3003-H14	23,200	21,500	14.0	54	5154-H32	41,900	31,800	19.0	61	5356-H32	46,300	32,000	24.0	54
— 18		24,000	21,900	15.0	58		43,000	31,900	22.0	68		46,600	32,100	24.0	62
—112		25,600	22,300	18.5	59		44,300	32,600	25.3	68		47,500	32,600	27.0	64
—320		36,600	25,900	32.5	56		62,300	37,400	34.0	53		63,900	37,100	34.0	53
75	3003-H18	30,400	26,700	9.0	34	5154-H34	43,800	34,600	17.0	55	5356-H34	53,200	40,100	16.5	51
— 18		32,000	28,000	8.0	37		44,000	34,600	19.8	62		53,900	40,400	18.5	55
—112		33,400	29,300	11.0	44		45,300	35,400	20.5	64		55,100	41,200	21.0	58
—320		42,800	33,400	23.0	46		55,800	39,800	23.0	58		73,400	47,100	27.5	43
75	5052-0	29,100	14,300	33.2	72	5154-H38	50,400	42,100	14.2	45	5083-0	45,400	21,800	23.0	35
— 18		29,200	14,400	35.8	74		51,000	42,300	16.9	55		46,700	21,000	24.5	39
—112		30,600	14,300	40.8	76		52,200	43,800	19.8	56		47,000	21,200	27.0	47
—320		44,800	16,800	50.0	69		67,400	49,900	24.4	48		62,900	23,800	33.0	38
75	5052-H32	32,200	24,400	21.7	72	5086-0	36,600	16,000	32.0	55	5083-H113	49,800	40,800	15.5	29
— 18		32,900	24,100	22.9	73		36,400	16,600	32.0	60		51,000	38,700	18.0	37
—112		34,800	24,300	26.3	74		37,100	15,600	36.0	62		52,100	42,200	19.0	40
—320		50,700	28,400	37.7	64		52,400	17,000	49.0	52		67,800	48,400	25.0	36
75	5052-H34	38,500	31,200	17.4	58	5086-H32	43,300	31,100	16.0	27	5456-0	50,800	24,100	20.0	26
—18		38,800	30,600	18.8	62		45,200	31,400	18.0	38		49,900	23,700	22.5	34
—112		40,700	31,800	21.0	60		46,900	32,200	23.0	45		49,700	24,000	25.5	41
—320		55,400	37,100	29.7	56		64,400	37,300	30.0	35		66,000	26,800	30.0	33
75	5052-H38	40,100	34,200	16.6	59	5454-H32	42,700	28,900	16.0	30	5456-H321	55,000	38,200	12.0	16
— 18		40,700	33,800	18.3	63		44,100	29,300	19.0	38		57,600	39,600	13.5	19
—112		42,400	34,300	20.6	64		45,500	30,300	22.5	44		57,500	39,200	17.0	27
—320		57,900	39,800	30.9	57		63,200	35,700	31.0	35		74,100	45,400	22.5	21
75											6061-T6	44,300	38,200	19.8	50
— 18												46,100	38,700	19.0	50
—112												48,100	40,200	20.0	50
—320												59,200	45,000	24.6	46

* Offset = 0.2 per cent

The low temperature ductility of aluminum made it practical to construct this entire oxygen plant of aluminum. The harp-type heat exchangers at the left are dip-brazed assemblies which contain thousands of tiny fins for maximum heat transfer. The structural utility of aluminum may be inferred from the fact that the tower at the right extends some 100 ft.



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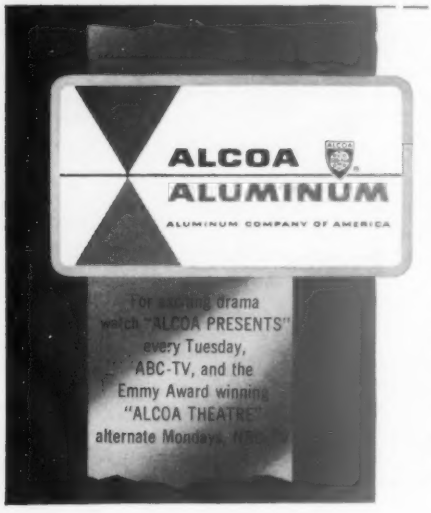

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What is linear programing

. . . and how do you put it to work?

Here's the first of three articles in which the author explains a useful tool in nonmathematical terms. Part 1 is a general introduction. Parts 2 and 3 get down to cases

BY JOHN E. CHENEVEY
Continental Oil Co.

LINEAR PROGRAMING is one of the newer mathematical techniques that has been developed since high-speed electronic computers have become available. The technique can be used to determine the most economic operation in a refinery where many streams must be blended into a variety of products. With all streams subject to certain restrictions and specifications the problem becomes one of determining the operation that will yield the most profit (or the least cost).

Before discussing the technique and seeing how it is applied, it is important that some of the terms are understood.

Linear programing . . . This is a mathematical method for selecting the best course of action from a number of possible actions in situations where the problem can be adequately described by a set of linear mathematical relationships.

It is extremely helpful where many choices must be made and where the choices are interacting, i.e., every choice affects every other choice, since it is very difficult to follow more than a few interacting choices by reasoning alone. The important requirements of the definition are that (1) it must be physically possible to perform an operation in a number of ways and (2) the operation can be described in linear form.

Linear terms . . . A linear mathematical relationship contains variables to the first (+1) power only, and the variables may be combined in one term. Terms such as $2xy$, $3/x$ or $3x/y$ are not permissible.

Strictly speaking, a linear mathematical relationship cannot contain more than two variables. Two first-power variables can be plotted as a straight line on a plane, three variables represent a plane in space, and four or more variables represent something which mathematicians call a hyperplane.

However, in connection with linear programing, any mathematical relationship, regardless of the number of variables, will be called linear if variables are to the first power only.

Matrix . . . For nonmathematicians, a matrix might be defined as a lazy man's way of writing a set of equations. A matrix sometimes is called a tableau.

$$
\begin{aligned}
2A + 3B \quad &+ 7D - 4E = 9 \\
A \quad - 2C \quad &- E = -9 \\
6B \quad - 4D \quad &= 8 \\
4A - B - 5C \quad &+ 2E = -5 \\
2B + 3C + D \quad &= 20
\end{aligned}
$$

Note that the equations are written so that each variable is in a separate column. The matrix is formed merely by making a neat table of the coefficients of the variables with the variables appearing as column headings. If the coefficient is zero, the space is left blank. Likewise, the equality sign is omitted. The numerical quantity column is headed Q or sometimes B.

A	B	C	D	E	Q
2	3		7	− 4	9
1		− 2		− 1	− 9
	6		− 4		8
4	− 1	− 5		2	− 5
	2	3	1		20

Simplex method . . . Another term frequently encountered in articles about linear programing is the simplex or modified simplex method of solution. The simplex method for solving linear programing might be defined as a procedure for algebraic solution which has been reduced to an efficient, foolproof, cook-book routine which can be followed blindly by a high-speed computer.

Problem Requirements

To be solvable by linear programing, the operation to be optimized must be describable by a set of linear mathematical relationships. These relationships are called restrictions and can be either equations or inequations. In addition, the profit, cost, or some other objective that we want to either maximize or minimize must be describable by a linear equation. This equation is called the objective function.

In general, linear-programing studies will be concerned with maximizing over-all profit.

Several things immediately come to mind which are important in refinery operations but are far from being linear relationships. The two most common are the yield-octane relationship in catalytic reforming and the TEL response of gasolines.

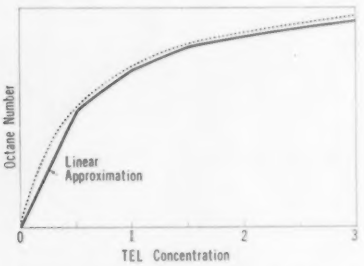
One way that curved relationships can be handled is illustrated in Fig. 1 for TEL response; the reforming curve would be handled in a similar fashion. The smooth data curve is approximated by a series of straight-line seg-

ments as shown in the bottom part of Fig. 1. The error from this type of approximation depends on the number of straight-line segments used. Greater accuracy is obtained if more segments are used, but the complexity is also increased.

For TEL response, satisfactory accuracy, at least for the interval from 1.0 to 3.0 ml. per gal., should be obtained by breaking the curve into 0.5-ml. segments and considering the responses to be linear within these intervals. For catalytic reforming, dividing the curve into linear segments 2.0 octane numbers (research plus 3 ml. per gal. TEL) wide should give acceptable accuracy.

Case studies . . . Linear-programing studies are different in a number of ways from the ordinary case-study type of calculation. These are:

1. Linear programing makes direct use of the profit relationship in obtaining the solution. In an ordinary case-study type of calculation a number of cases are set up and worked through. Then dollars and cents are put on the results to pick out the best case. In linear programing the profit relationship is used in the computation procedure and the results for only the best case are obtained.



LINEAR APPROXIMATION of TEL response curve. Fig. 1.

2. A linear-programing problem is usually defined in terms of limits rather than fixing variables rigidly. Such limits are set up by means of inequations, which specify that given variables can be no greater than (or in other cases no less than) certain values.

In other words, rather than setting how much crude should be run in a given refinery situation, the maximum permissible crude rate is specified. This setting of limits corresponds more closely to limitations encountered in actual operations. Thus, well-defined physical limitations are used rather than arbitrarily assumed values.

The set of restrictions defining a linear-programing problem are transformed as a part of the computation procedure, into a set of simultaneous equations. However, the number of real variables usually exceeds the number of restrictions, or stated the other way around, linear programing does not require that there be as many equations as there are unknowns.

Since there are more unknowns than there are equations, the method for solution of simultaneous equations cannot be used and a different solution technique is required. This solution technique is iterative. In other words, the final solution is approached by a stepwise series of better and better approximation. The computation procedure also indicates when the final solution has been reached.

3. Linear-programing computation method prohibits negative values for any variable. It prevents meaningless answers, such as charging a negative amount of feed to a processing unit or producing a negative amount of an unprofitable product, thereby indicating a fictitious profit. Although variables cannot take on negative values, this does not prohibit a variable having a negative coefficient. The term 6A indicates a negative 6 coefficient multiplied by a positive A.

Advantages . . . Linear programing has a number of advantages over more familiar types of calculations.

1. The biggest advantage is probably that a greater number of variables can be unassigned and allowed to seek their best levels as determined by the conditions of the problem. This permits putting lots of flexibility into the problem and eliminates the need to arbitrarily assign values to many of the variables. In the usual studies most variables would be assigned reasonable values based on past experience and the effects of only two or three variables would be investigated. Being able to handle many variables eliminates the need for a lot of second guessing.

2. A linear-programing solution is the optimum solution for the ranges of conditions specified in the problem. This means that one linear-programming solution is equivalent to a number of sand-calculated cases.

For example, it requires nine cases to evaluate all combinations of only three levels for each of two variables.

3. It evaluates all possible combinations of variables within the ranges permitted by the problem. It can't miss the optimum.

In comparison, in the case-study calculation, the best of the cases calculated can be readily selected, but if the choice of cases considered was unfortunate, it is possible that conditions for the true optimum were never evaluated.

4. All of the variables seek their optimum levels simultaneously so that all the physical interactions and cost considerations are satisfied. When the final solution is obtained, all material balances and quality specifications will check out and the solution will be the maximum profit conditions. Indeed, all of these conditions except maximum profit will be satisfied at any iterative point in the computation.

For example, in a refinery problem the amount of reformate blended to gasoline will always check back through the amount of naphtha fed to the reformer, and back through how much of the naphtha yielded from the crude was put to other uses, and still farther back to the amount of crude charged.

5. No arbitrary cost allocations need be made. Linear programing looks at the problem as a whole. By setting up the problem for different conditions, different over-all profits will be obtained and the difference in these profits will be due to the changes made in the problem.

This procedure avoids the problem of assigning costs encountered where, for example, a single processing unit produces two or more products. How should the raw material and operating costs be allocated among the products? Should the allocation be on the basis of volume or value of the products?

Conclusions reached may depend on how these costs are allocated, and care must be used to avoid being misled. Linear programing avoids this confusion by assigning costs in the problem set up at places which correspond to the places that costs occur in actual operation. Then it evaluates profit on an over-all basis.

Inequations . . . Consider the equation:

$$x + 2y = 2$$

Plotting values of x and y which satisfy this relationship results in straight line A-B in Fig. 2. This means that for any given value of x there is one and only one value for y which will satisfy the equation. For example, if x is 1.0 then y must be 0.5. Specifying some requirements in a problem by an equation fixes that requirement within specific limits and does not permit much opportunity for variation, since permissible values can move only along line AB.

If instead of an equation, the requirement is expressed in terms of an inequation:

$$x + 2y > 2$$

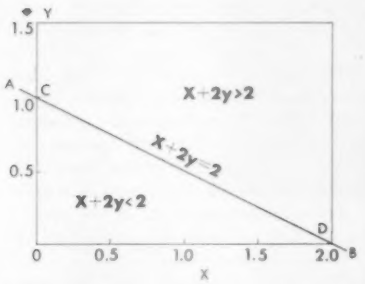
where $>$ means "is greater than," then for any given value of x there are many values of y which satisfy the relationship. If x is 1.0, any value for y greater than (but not actually

including) 0.5 is permissible. In Fig. 2 any point above line AB satisfies this inequation. Likewise:

$$x + 2y < 2$$

where < means "is less than," is satisfied by any point below line AB. For example, if x is 1.0 any value for y less than (but not including) 0.5 is permissible.

In Fig. 2, the equation limits our choice of values for x and y to only those pairs which fall along line AB,



INEQUATIONS establish upper and lower limits instead of fixing the problem rigidly. Fig. 2.

while inequations permit choice of many pairs of values as long as they fall either above or below the line according to which inequation is being considered.

Setting up a problem in terms of inequations rather than equations does not specify the problem as rigidly and provides more flexibility. This should be the goal in linear programing. Fixed values should not be assigned to possible variables.

We want to establish upper and lower limits beyond which it is undesirable or impossible to operate. This excludes areas which should not be considered, but permits investigation of the full range between limitations, making all those values available to the solution of the problem.

Describing a problem in terms of inequations sets limits on the variables. This corresponds more nearly to the actual situation encountered in plant operation, where physical limits are set by pump capacities, heat transfer rates, flow velocities, etc. While defining a problem in terms of limitation includes a wide range for the variables, the profit equation guides the solution quickly in the right direction. Having a wide range of possible answers does not increase the time for solution significantly.

To be strictly accurate, an inequation approaches but does not include values satisfying the corresponding equation.

For example, neither of the inequations $x + 2y > 2$ nor $x + 2y < 2$

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Design Economics of Heat Exchangers Furnish Basis for Heat Transfer Cost Engineering

The application of cost engineering practices in the accurate evaluation of capital equipment in the process industries is rapidly becoming more and more vital to the management of process companies, as margins of profit grow narrower.

Management now depends increasingly, therefore, on modern cost-engineering practices to evaluate realistically the true, long-range economy of a given piece of equipment in relation to its initial cost, cost of installation, maintenance, operation, labor, replacement — and in relation to the productivity or profit of the process involved.

The importance of efficient, practical, long-range forecasting is increasingly a focal point in the process industries as a whole, but no where is it more important than in the purchase and operation of heat exchangers for use in continuous flow processes, where the operation of the unit never ceases, and therefore must be calculated on a basis of maximum longevity, efficiency and service. Included in the design of each heat exchanger must be a consideration of its initial cost, its cost of installation (including piping, fittings, valves, flanges, etc.), its operation and maintenance (including corrosion-protection, mechanical maintenance, cleaning, re-tubing, replacement parts) — and the factor of labor costs attendant to the installation, operation, maintenance and/or replacement of the unit.

In each case, however, the basic factors must be considered and determined: capital, overhead, maintenance and unit process costs.

The Cost Engineer, therefore, must be committed to continual study, re-examination and revaluation of every area which contributes to the practice of chemical engineering, for it is from his fundamental and technical knowledge of the process involved that his eventual forecasts for productivity, efficiency and longevity must ultimately spring.

Considerable thought has been given to the "ideal" background or qualifications for the Cost Engineer. Certainly his primary requisite must be a thorough knowledge of chemical engineering, including, in the heat transfer field, an equally intimate grasp of the thermal and metallurgical engineering so vital to an understanding of heat exchanger design economics.

Secondly, he should have had practical experience in the production phases of the chemical business. Thirdly, he will be better equipped to understand the complexities of the "business" side of such evaluations, if he has had education and/or experience in a certain amount of business administration.

Clear, concise, understandable communications is another factor of great importance to the ultimate success of the Cost Engineer, for he must transmit his findings, make his recommendations and defend his decisions to a number of widely varied types of people, some with technical background and others with little or no technical knowledge.

The Cost Engineer must be tireless on detail, inquisitive at each point, yet tactful in his demands on subordinates and associates. Above all, although cost engineering presents a real challenge to his analytical mind, he must serve his purpose with genuine humility, cognizant of the amount he has yet to learn.

In short, he should have a proclivity towards the functions of management, for that is where he might very well be headed.

(FOOTNOTE: For more detailed information on this subject, write for your free copy of "Cost Engineering" to WESTERN SUPPLY COMPANY, HEAT EXCHANGER DIVISION, P. O. BOX 1888, TULSA, OKLA. — and for immediate assistance on heat transfer cost engineering, feel free to suggest our services . . . whether or not there's a heat exchanger in your company's future!

includes the values satisfying the equation $x + 2y = 2$. If the values satisfying the equation are to be included in an inequation, use is made of the symbols $\geqq$ and $\leqq$ which mean "is equal to or greater than" and "is equal to or less than" respectively.

Slack variables . . . Algebra cannot handle inequations directly. Therefore, some manipulation is necessary to transform inequations into something that can be handled mathematically. This change is made by adding to each inequation a "slack variable." It is an added variable that takes up slack in the system.

Consider the inequation:

$$x + 2y \geqq 2$$

This can be transformed into an equation by adding a slack variable to the right-hand side.

$$x + 2y = 2 + A$$

The new variable A can take on any value required, depending on the values for x and y, to make the equation hold. This slack variable is then handled algebraically the same as any other variable. Remembering that in linear-programing variables cannot take on negative values, the value for A can vary from 0 to positive infinity. The zero value would correspond to the case where $x + 2y$ is exactly equal to 2 and the infinity value would apply when x and/or y becomes infinitely large.

Likewise, for the inequation:

$$x + 2y \leqq 2$$

the slack variable would be added to the left-hand side.

$$x + 2y + B = 2$$

B could take on value from 0 to +2; 0 when $x + 2y = 2$, and 2 when both x and y are zero.

Slack variables do have physical significance. As an example, consider blending gasoline to a Reid-vapor-pressure specification of 10.0 maximum. Mathematically, this requirement would be represented by the inequation: Bbl. (1) × R.v.p. (1) + bbl. (2) × R.v.p. (2) + etc. $\leqq$ 10.0 × [bbl. (1) + bbl. (2) + etc.].

Bbl. (1) represents barrels of component 1 and R.v.p. (1) represents the R.v.p. for component 1, etc. This inequation would be transformed into an equation by adding a slack variable, S: Bbl. (1) × R.v.p. (1) + bbl. (2) × R.v.p. (2) + etc. + S = 10.0 × [bbl. (1) + bbl. (2) + etc.].

The slack variable represents the number of R.v.p.-barrels in the actual blend less than the maximum number that would be permitted by the specification. If the value of the slack in the final solution turns out to be zero it would mean that the R.v.p. of the blend was exactly 10.0. If the slack comes out with a positive value it would mean that the R.v.p. of the blend was less than 10.0. By back calculation the exact value of the R.v.p. for the blend can be obtained. In the above case the R.v.p. of the blend would be:

$$\frac{10.0 - S}{\text{bbl. (1)} + \text{bbl. (2)} + \text{etc.}}$$

The physical significance of this slack might be termed quality giveaway, since it represents the product having better quality than the specification limit. In other cases the slack might represent a raw material which is available but not used or the physical capacity of some equipment which is not completely filled.

In another common case the slack might represent unfilled product demand, i.e., product that could be sold if made, but which was not made because making it would be unprofitable.

All slack variables must be included in the profit equation with proper profit coefficients associated with them. If it makes no difference whether or not a nonzero value for the slack appears in the final solution, a zero coefficient is assigned.

As another example, if a premium can be gained by making a product of better quality than the minimum specification, some positive coefficient would be used. Similarly, a penalty for a salable but underspecification product would require a negative coefficient. If a product has an alternate value, this positive alternate value might be used. In any event, the profit coefficient to be associated with each slack variable depends on the physical significance of the particular restriction containing that slack.

Sometimes we want a slack variable to be zero in the final solution, for comparison with results when the slack is allowed to take on its optimum value. This can be accomplished by assigning a large negative coefficient to the slack in the profit equation. Such a coefficient would mean that it would be very unprofitable to have the slack appear in the final answer with a nonzero value. With a high negative-profit coefficient, the computer will reduce the slack to zero in the final solution if at all possible. This technique is called "forcing to zero."

For example, if it is desired to make a blend of exactly 10.0 R.v.p. in the

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Here's what we mean: The Pipeline Welding and Construction Company of Oswego, Kansas is building a cross-country pipeline in rural Minnesota. Since the pipe is buoyant and is being laid in swamps, marshes and lakes, it has to be anchored in place by 3,000-pound concrete jackets. It used to take 20 men with tools plus 2 sideboom tractors plus 1 dragline boom tractor plus flotation gear plus 10 solid hours of labor to lay 20 of these 3,000-pound concrete jackets. That was before a Sikorsky S-58 helicopter was put to the task. Now it takes just 4 men less than an hour to do the same work. Peewee Vaughn, project foreman, says, "I'll never again do a cross-country job like this without a helicopter." Pilot John Sharbrough says, "The Sikorsky helicopter is the only helicopter that could possibly do this job, and it's a machine that will do everything the manufacturer says it will do." Think about your own business for a moment. There might be a place for Sikorsky helicopters to open up a whole new area of savings. We'll be glad to discuss it with you.

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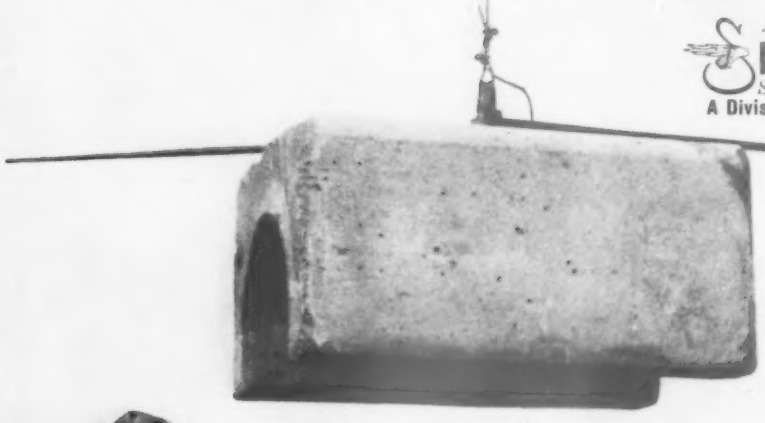


previous illustration, a large negative profit coefficient, say —$10.00, would force the slack, which represents R.v.p. barrels under the specification limit, to zero and produce a blend right on the specification limit.

Artificial variable . . . This is somewhat similar to a slack variable, since it is added to a restriction, but there are important differences.

An artificial variable is added to a restriction which is already in the form of an equation rather than an inequation. Accordingly, an artificial variable has no physical significance; it is put in merely as a convenience in manipulating the problem and its value is always forced to zero in the final solution.

The use of artificial variables is legitimate, since they do not influence the final answer in any way. Their use is a sort of mathematical trickery which helps solve the problem but does not affect the results. A large negative profit coefficient must always be assigned to the artificial variables in the profit equation to force them to zero in the final answer.

There is another situation in which an artificial variable is used. Consider the previous example $x + 2y \geq 2$ which is transformed into an equation by adding a slack variable S as follows: $x + 2y = 2 + S$ which is equivalent to $x + 2y - S = 2$. It is a requirement of the usual linear-programing-solution technique that a restriction arranged as immediately above must have the same sign on the slack variable and the numerical quantity. If this is not the case, an artificial variable A is added to the equation as follows: $x + 2y - S + A = 2$. This restriction now contains both a slack and an artificial variable, and the artificial variable has a positive sign to match the $+2$.

Summary . . . A linear-programing problem is described by a set of restrictions which describe the conditions we wish to fulfill. These restrictions can be either inequations or equations and in general there will be about as many real variables as there are restrictions. Either a slack variable or an artificial variable is then added to each restriction depending on whether the original restrictions were inequations or equations. This results in about twice as many variables (real, slack, and artificial) as there are equations.

Any system of equations having more variables than equations has many combinations of values for the variables which satisfy all of the equations. Therefore, some additional conditions must be specified to select the desired combination. In a linear-programing problem the profit equation is used for this final selection. Every variable, real, slack, or artificial, must be included in the profit equation with an appropriate profit coefficient assigned to each variable.

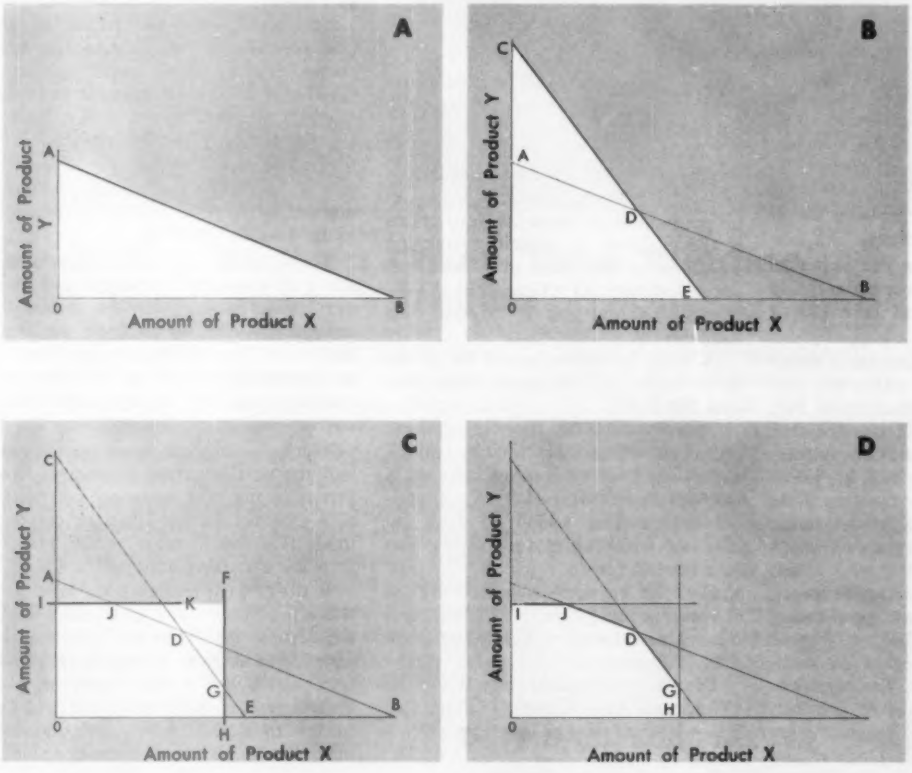
Graphical Problem

A graphical representation of a linear-programing example may help in understanding how a maximum profit solution can be obtained. Since the problem must be represented on a two-dimensional sheet of paper, it is necessary to limit the problem to two variables. (Three variables could be represented but the diagram would become hopelessly confusing.) The same reasoning will apply, however, regardless of the number of variables involved.

Suppose a chemical company is expanding its product line and expects to make two new products. These products are quite similar and are made by a two-step process in which a reaction step is followed by a purification step, which will be assumed to be a simple distillation. The same reactor and distillation equipment will be used for both products in blocked-out operation.

To simplify the problem still further, assume that sufficient intermediate storage is available so that operation of the reactor and distillation column can be independent of each other.

How much of each product, designated as product X and product Y, should be made to get the maximum profit?



FOR ANY production rates in the unshaded area, it is possible to both produce and sell all of the products. This is called the region of feasibility. Fig. 3.

Refer to Fig. 3A and consider the reaction step only. If no product X is made, the reactor could produce A units of product Y. If no product Y is made, B units of X could be produced. For any intermediate production of X and Y the points representing full use of reactor capacity would lie along line AB. Line AB therefore represents the reactor-capacity limitation on the problem, and it is physically impossible to operate in the cross-hatched area above this line.

By similar reasoning, purification-capacity limitation can be determined. This is represented by line C-D-E in Fig. 3B.

The physical limitations on the system having been established, it is necessary to also consider any sales limitations. The best estimates of maximum product sales are obtained and indicated in Fig. 3C. If maximum sales of product X are estimated as H units, then vertical line FGH excludes another area from consideration. Likewise, horizontal line IJK excludes an additional area due to sales limitations on product Y.

Remembering that linear-programing-solution technique prohibits negative values and common sense also tells us that we can't make a negative amount of product, the areas to the left of line AO and below line OB in Fig. 3A are also excluded. If all excluded areas are combined as in Fig. 3D, everything has been excluded except the area bounded by lines OIJDGHO.

This is known as the region of feasibility and, for any production rates X and Y, represented by points in this area, it is possible to produce and sell all of the products. Conversely, for any production rates represented by points outside this area, it is either not possible to produce or to sell the indicated quantities.

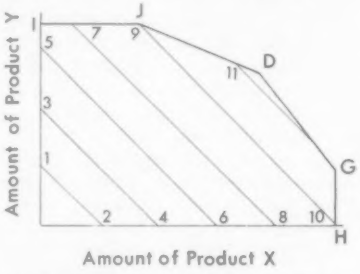
This example shows the function of restrictions in a linear-programing problem. It is to bound in a closed region of feasibility.

There remains the selection of maximum profit conditions within the permissible region. It is obvious in Fig. 3D that maximum profit is associated with operating at conditions represented by corner points I, J, D, G, or H, or along the lines connecting these points. The problem is to determine exactly what point represents optimum operation.

Determination of maximum profit conditions can be shown by drawing isoprofit lines, as in Fig. 4. Fig. 4 represents the same region of feasibility shown in Fig. 3D. The combinations of production rates of products X and Y, which will produce, say $1,000 profit, can be determined and represented by a straight line such as 1-2 in Fig. 4.

Similarly parallel line 3-4 would represent production rates giving $2,000 profit, line 5-6 representing $3,000 profit, and so on. This is continued until the point of maximum profit is indicated, which in this illustration is D.

Fig. 4 indicates how relative profitability of the two products influence selection of the optimum point. The slope of the isoprofit lines depends on relative profitability. Where both products are of approximately equal profitability, point D would be selected. However, if product Y is considerably more profitable than product X, point J would be selected, and if product X is considerably more



ISOPROFIT lines approach D as the limiting value on profit. Fig. 4.

profitable, then point G would be selected. Since different profitabilities may give different answers, it is important that accurate economic values be used in linear-programing problems.

Numerical solution . . . Actual problems are of course solved by numerical methods.

Considering the example solved graphically, the capacity limitations and sales limitations would be set up in mathematical form as restrictions in the problem. A capacity restriction would be in the form of a time balance: (Units X) (Time/unit X) + (Units Y) (Time/unit Y) $\leqq$ Total time available.

A sales limitation would be in the form: Units X $\leqq$ Maximum sales forecast for X.

There would be four restrictions, one each for reactor capacity, purification capacity, maximum sales of X and maximum sales of Y. Slack variables would be added to each inequation resulting in four restrictions in standard form.

For the reaction step: (Units X) (Time/unit X) + (Units Y) (Time/unit Y) + Unused time = Total time available.

For the purification step: (Units X) (Time/unit X) + Units Y) (Time/unit Y) + Unused time = Total time available.

For the sales limitations: Units X made + unfilled sales demand for X = Maximum sales forecast for X, and Units Y made + unfilled sales demand for Y = Maximum sales forecast for Y.

A profit equation is required in addition to these four restrictions. Reduced to its simplest form the profit equation would be: Total profit = (Units X) (Profit/unit X) + (Units Y) (Profit/unit Y).

The problem has now been defined in terms of four restrictions, with two real and four slack variables, and the profit equation.

The solution procedure starts by assuming that no product is being made and consequently no profit is being made. This is a good place to start, since in a large problem much time could be wasted looking for a better starting place. It is more efficient to start at a point where it is always possible to start. The profit equation moves the trial answer to more profitable conditions rapidly.

The restrictions and profit equation arranged in standard form correspond to the "do-nothing" condition represented by point 0 in Fig. 4. The profit equation is then examined to determine what single change can be made to produce the most increase in profit.

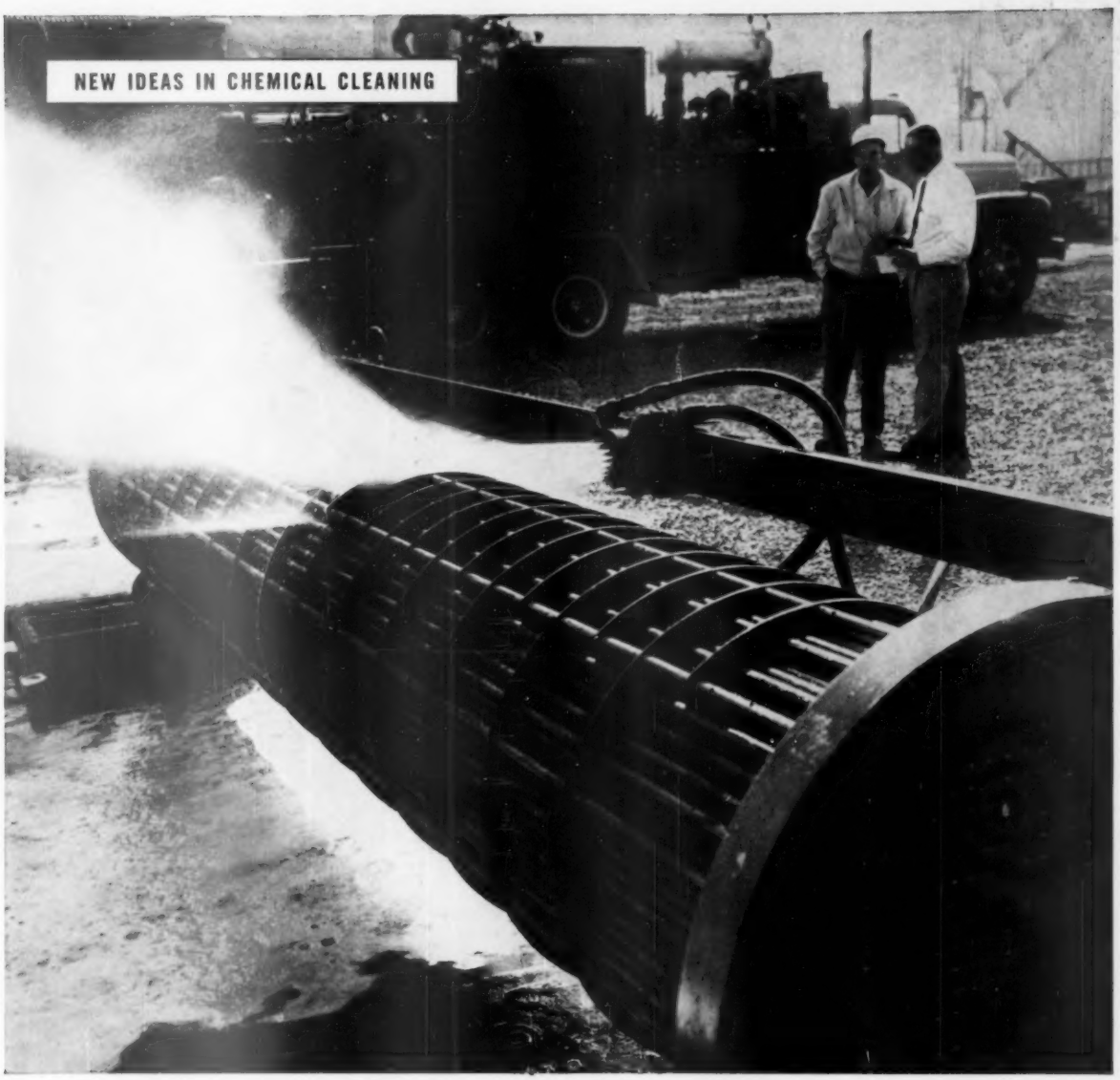
In this case the profit equation would say in effect: Make as much of product X as possible. This would correspond to moving to point H in Fig. 4.

The restrictions and profit equation are adjusted to account for this change and again the profit equation is examined to select the next change. In this case the answer would be to fill up the purification capacity by making as much as possible of product Y in addition to the previous amount of X. This would correspond to moving to point G.

The equations are again rearranged, the cost equation examined and the next move made. Here the indicated change would be to back off on production of X and increase product Y until both the reaction and purification sections are used to capacity. This corresponds to moving to point D.

The equations are again rearranged and the cost equation examined. But this time the cost equation will indicate that no further changes can be made that will increase profit. Therefore the last conditions are optimum.

It may be difficult to see how the numerical procedure guarantees that the results are optimum. Mathematicians have proven to their own satisfaction that this is true; however, for disbelievers a more practical test is to try to find a better solution by other means. It hasn't been done yet!



New Jetting Tool To Clean Tube Bundles Saves Thousands Of Dollars

The new high-pressure hydraulic tool, shown above, is currently saving thousands of dollars for companies in the refining, chemical, and petrochemical industries. It is the jetting tool developed by Dowell to remove deposits from heat exchanger tube bundles.

Previous methods of cleaning these bundles have been costly, time-consuming and often inadequate. Many times bundles had to be replaced completely because of the lack of a suitable cleaning method.

This new tool has a remarkable record of thorough, fast cleaning. For example, a slurry reboiler exchanger bundle, three feet in diameter and 16 feet long, was fouled with deposits of coke and asphalt. After being jetted from only one side, the bundle was thoroughly clean. Time required: less than one hour.

The tool holds the bundle in place for cleaning and has flanged rollers for rotation. The jet-head is manipulated automatically so that all tube spaces are covered. The jetted liquid can be either water or chemical solvents.

The new Dow Industrial Service Division will continue to offer the service which was formerly provided through the Dowell Division. For engineered recommendations to solve your cleaning problems contact the field office nearest you, or write Dow Industrial Service, 20575 Center Ridge Road, Cleveland 16, Ohio.

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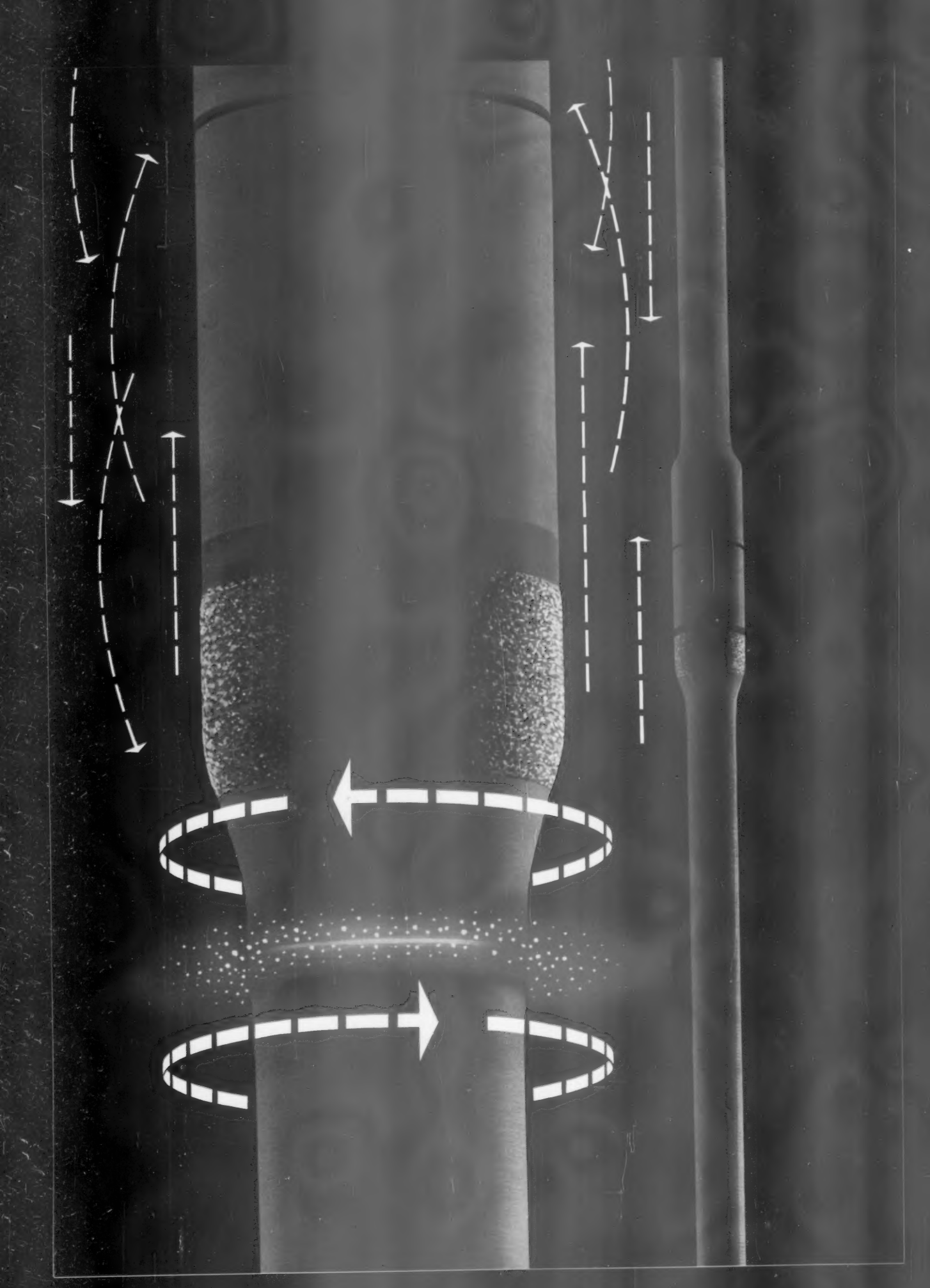

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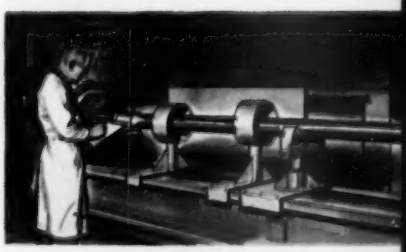

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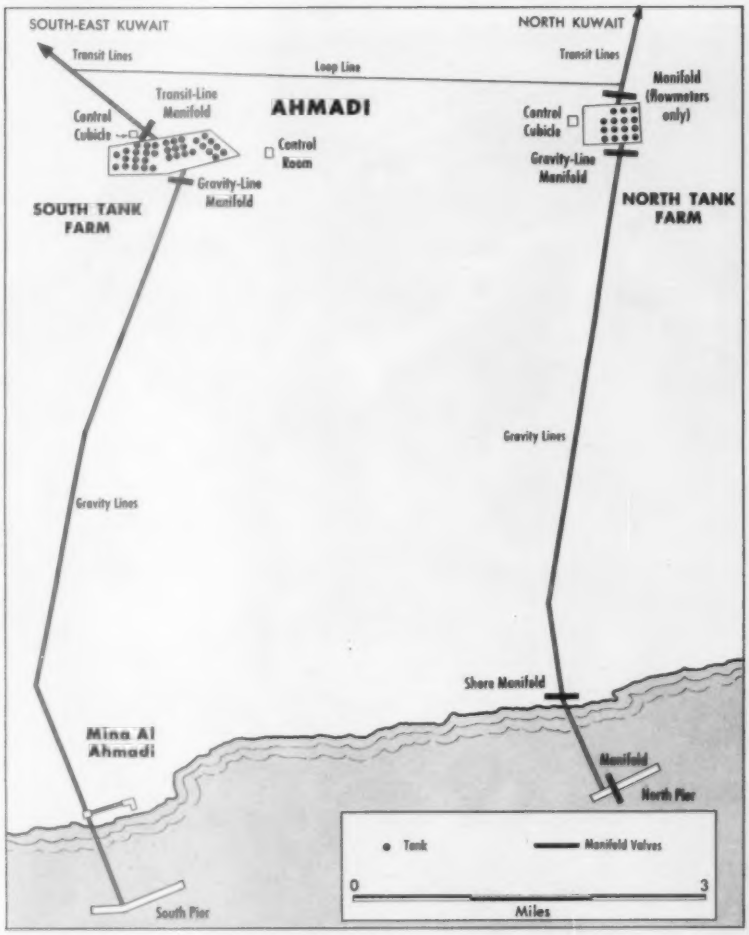

CRUDE MEASUREMENT AND LOADING of tankers will be placed under supervisory control to improve accuracy and efficiency in Kuwait facility.

Kuwait terminal switches from manual to remote operation

THE 1,500,000-bbl.-daily production of Kuwait Oil Co., Ltd., largest unit production in the world, passes through the north and south tank farms at Ahmadi before loading tankers. A small percentage of the crude is bypassed for processing in the company's refinery to supply local needs for motor fuel and for the manufacture of bunker and diesel fuels.

These volumes have to be agreed to by the chief oil inspector of the Kuwait Government and the oil company's stores division before royalty payments can be fixed. Manual gaging of tanks by dip-tape and temperature reading by thermometer still provide the basis for calculating crude volume. They are at this time the only methods mutually accepted, even though they of course entail considerable margin for error.

A difference of 0.1 in. in the dip of a 150-ft.-diameter tank, which is very easily made, amounts to quite a large volume of oil. The temperature, too, can vary widely in different sections of a tank.

Supervisory control system. Since the manual method is at best tedious, requiring considerable manpower, an effort is being made to replace it with a remote, supervisory-control system.

The system has been designed by the engineers of Kuwait Oil and a firm of British manufacturers of control equipment. Control and supervision of the north and south tank farms, together with control of the manifold valves on the north pier loading terminal, is achieved from a centralized control room in Ahmadi (see drawing).

The control-room equipment is connected by underground cable to remote cubicles located near the two tank farms and the north pier and from there to the various valves and tanks being controlled. In the event of a main cable or equipment failure, the respective areas can be controlled from this remote cubicle, which is normally unmanned.

The control board is arranged in three sections, forming a composite board for the whole arrangement, with a mimic display showing tanks, valves, and associated pipelines. Facilities are available to control and supervise 35 tanks in the south tank farm and 15 tanks in the north tank farm, plus associated manifold valves controlling flow in the filling and loading lines to the loading terminals.

In general, the valves are controlled on an open-stop-close basis with lamp indication of the valve position. in certain instances, where required, valves can be "inched" with precise valve-position back indication.

Control - room facilities. Available control functions and supervisory indications are:

1. Precise liquid-level indication of individual tanks.
2. Tank high-low level alarms with safety interlock on input valve.
3. Open-stop-close control of tank inlet and outlet valves.
4. Lamp indication of tank-valve positions.
5. Open - stop - close control of transit-line, gravity-line, and loop-line manifold-valve positions.
6. Lamp indication of transit-line, gravity line, and loop-line manifold-valve positions.
7. Inching control of selected valves.
8. Precise bank indication of valve position, where inching control is fitted.
9. Indication in barrels per day of the rate of flow in selected transit and gravity lines.

Control equipment has been engineered to provide for remote indication of average tank temperature of the individual tanks at a future date.

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This will be achieved by the operator on demand.

It is hoped that the remote gaging and supervisory system will prove acceptable to the parties concerned so that the manual method may be replaced as a basis for determining royalties and for tanker loading.

LINE-FAULT ANALYZER is used by W. E. Bryan, United Gas Pipe Line Co., to locate trouble on a company telephone line.

Trouble spotter guards against breakdown of communications

A QUICK SYSTEM of spotting telephone-line trouble plays an important role in assuring dependable communication on the United Gas Pipe Line Co. system.

Center of this trouble-finding system is an instrument called a line-fault analyzer located in the general offce-communications department in Shreveport. Others like it will be placed in district offices.

The analyzer, a small, radar-like instrument, is designed for rapid location of faults on wire-line systems. From 200 miles away, it can tell its operator, within a few feet, where the trouble source is.

The instrument analyzes the situation along a telephone or telemetering circuit when trouble occurs. Line faults such as wire breaks, short circuits, and grounds, are easily recognized and their location is easily determined by noting the distance from the fault to the nearest known point on the line. A dial calibrated in fractions of a mile provides an accurate means of pinpointing the fault by offering a direct distance reading.

The nature of the fault is indicated by the type of "pip" displayed on the oscillograph screen. A broken wire produces a pip of a different shape from a short circuit, ground, or other types of faults.

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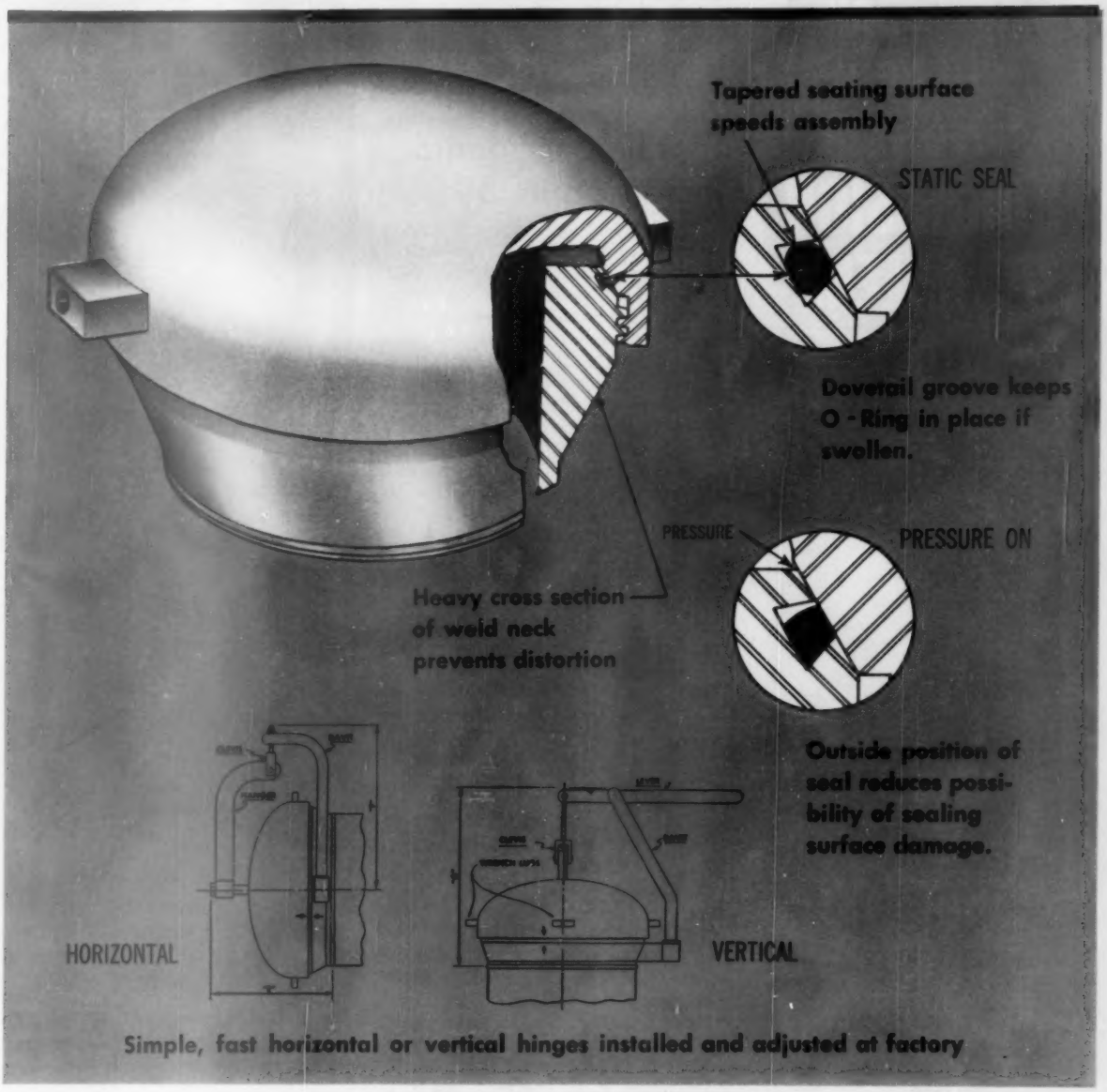
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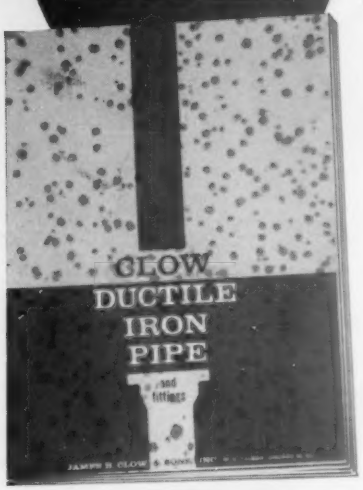

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analyzer is radioed to line crews, thus speeding repairs and minimizing delay in restoring circuits to normal operation. The company-owned telephone system is relied upon heavily by dispatchers in regulating the flow of gas. Use of the line-fault analyzer contributes to efficient operation and uninterrupted service by keeping communication outage as low as possible.

Pipeline accidents increased in '59

The accident-frequency rate among members of the Pipe Line Contractors Association increased last year over the excellent performance in 1958.

With 13 million man hours worked in 1959, the rate was 43.98 compared with 36.9 in 1958 and 42.8 for the average of the last 4 years. The PLCA at its annual convention made safety awards to the superintendents whose spreads had the top records.

Several superintendents had no lost-time accidents and worked at least 10,000 man-hours. They were Jack Whitlock, J. L. Cox & Son; L. L. Rowland, F. P. Fox, Enwood Thompson, H. W. Gandy, Cliff Hammett, and Joe Pye, Dunn Bros.; Al Heath, Engineers Limited Pipeline Co.; Cecil L. Jernigan, Hood Construction Co.; M. H. Spradley, R. S. Moody, and H. D. Wilson, Horizontal Holes; A. J. Slovack, Houston Contracting Co.; Kenneth Wagner and R. W. McKee, McVean & Barlow, Inc.; James R. Zeman and T. D. Stout, Pentzien, Inc.; W. H. Olrich, G. A. Reutzel, and R. L. Ezell, H. C. Price Co.; J. W. Brown, Sheehan Pipe Line Construction Co.; Grover R. Moreland, Trojan Construction Co.; G. W. Hamilton, Joe Young, and Reuben Lewis, Williams Brothers Co.

Those who worked 100,000 man-hours and over and had an accident-frequency rate below 30 were James McGill and Art Fry, Contracting & Material Co.; Harold Mehail, Engineers Limited Pipeline Co.; M. L. Thompson, R. E. Thornton, and R. L. Silar, Houston Contracting Co.; G. H. Mattock, Latex Construction Co. of Georgia; M. D. Wagner, McVean & Barlow, Frank Clark, J. P. Neill & Co.; Nelson VerSoy, M. J. Lane, C. E. Shivel, and C. R. Ice, H. C. Price Co.; Harlan Evens, Tommy Thompson, C. E. Casper, and A. M. Garber, Williams Bros.

In the 25,000-100,000 man-hours group with a rate of 30 or below were G. M. Short, Fulton; L. A. Young, Houston; F. W. Johnson and R. D. Copeland, Latex; C. M. Brown, Sheehan; W. B. Winfrey, Trojan; and E. W. Saulsman, Williams Brothers.

Natural gas producers in Texas and Louisiana are assured a stable market for their output via Transco, pipeline to the markets where the most people are.

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The new look in alkylation

Breaking the skyline at Linden, N. J., is a new silhouette. It's the outline of 42 big 50-hp LIGHTNIN Mixers atop huge alkylation reactors at Esso Standard Oil Company's Bayway refinery.

These mixers deliver a powerful, steady turbulence that instantly disperses incoming olefins, keeps hydrocarbons from separating anywhere in the reactor, promotes maximum acid economy and light alkylate yield. The mixers operate continuously, 24 hours a day.

To the success of this process MIXCO engineers contributed many hours of research into the fluid mechanics of alkylation, and specialized knowledge of mixer impeller performance under varying reactor conditions.

When you are designing a process or fitting out a plant, you can count on the same skills—in fluid mechanics and in equipment design—to minimize your operating costs. Your LIGHTNIN Mixer representative can give you full details. Or write to us in confidence.

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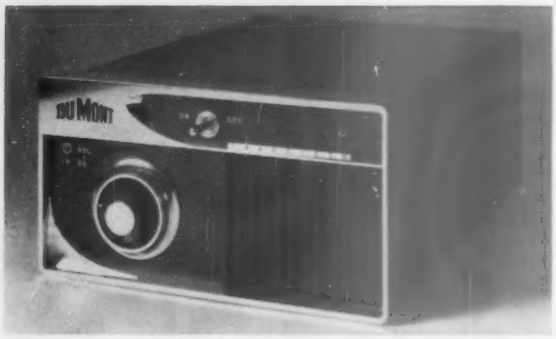
MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 174-c Mt. Read Blvd., Rochester 3, N. Y. In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont

▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .



Latest mobile radio set

. . . available is this Transicom, a medium-power transmitter/receiver unit that is exceptionally compact for mounting under the dashboard of vehicles. The mobile-radio set uses a combination of transistors and other semiconductors together with vacuum tubes.

The transmitter/receiver measures 4½ in. high, 8 in. wide, and 12 in. deep. The first units to be produced, Type MCA 325, will be for the 144-174 mc. band and will be available with transmitter power ratings of 10, 20, and 30 watts. Features include a special 3 by 5-in. speaker built directly into the front panel as an integral part of the radio set and integrated with an audio chamber directing the sound to the driver's ear.

For simplicity and to reduce confusion to the driver and operator at night, only two basic controls are used on the front panel. One is a double-function power switch. The second is a combination volume and squelch control. Delivery time after March: immediate. Approximate price, f.o.b. factory, ranges from $400 for a 10-watt unit to $425 for a 30-watt unit. Source: **Allen B. Du Mont Laboratories, Inc., Clifton, N. J.**

●

Prevent paraffin

. . . deposits in wells with a new method. The method involves a combination of chemicals and a special preapplication technique. According to the maker, the chemicals alone will not solve a paraffin problem because they are not solvents and will be ineffective if used in an effort to remove paraffin already deposited.

All metal parts must be free of any oil, wax, and paint before treatment. After they are cleaned, regular periodic application of the chemicals will make the metal parts of the well water wet and prevent adhesion of paraffin particles to the clean water-wet surfaces. Application of the chemicals is like that of other downhole treatments. Cost of the application depends upon the preparation of the well and the quantity of chemical required to prevent paraffin deposits. Field tests indicate that less than 3 cents per barrel of fluid produced will keep the well equipment clean, according to the maker. Source: **Dowell Division of The Dow Chemical Co., P. O. Box 536, Tulsa.**

●

X-ray machine

. . . that is portable, has a power rating of 300 kv., a penetration capability of 4-in. steel, and a total weight of 150 lb. Designated the Baltograph 300, the machine has an X-ray head that is cylindrically shaped. It measures 46¼ in. long with a diameter of 12¼ in.

The head includes X-ray tube, lead shielding, transformer, filament heating transformer, automatic thermal cutoff, and a receptacle for the control-panel connector cable. The control panel is enclosed in a dust and weatherproof metal cabinet. It includes a penetration meter, penetration selector, presetting control, and automatic reset timer operated by a push button. Measuring 15 by 12 by 7 in., the panel weighs 41 lb. Two carrying cases are provided for the two components. Delivery time: 4 weeks. Approximate price, f.o.b. factory: $6,900. Source: **Balteau Electric Corp., 25 New Street, Stamford, Conn.**

Want more facts about equipment or copies of product literature described in this issue?

Send this **Showcase Coupon**

to manufacturer at address shown in bold type after each item.

Product name, Model no., literature title or number:.....

.....

Described in OIL AND GAS JOURNAL - Issue of March 7, 1960

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COMPANY.....

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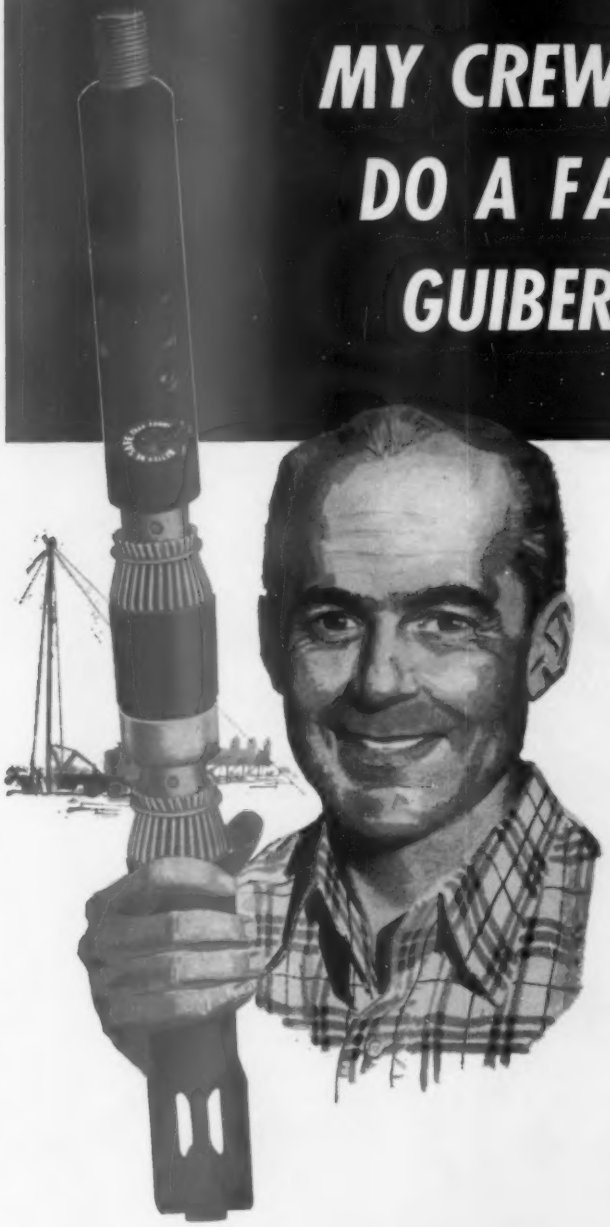
MY CREWS DO A FASTER JOB with GUIBERSON SWABS



There's no substitute for a fast-falling, smooth-pulling Guiberson swab in speeding-up swabbing operations. Crews make fewer trips .. do a better clean-out job .. lift more fluid per hour. So naturally they're in and out quicker .. at the *lowest possible* swabbing cost. Match one of these cups to your swabbing job.

TYPE J .. lifts heaviest loads
TYPE L .. lifts medium or light loads
TYPE GW .. for light loads
TYPE K .. general purpose cup to 6,000 feet
SIMPLEX .. lifts fluid containing suspended sand

More than a third of a century of swab-making experience is behind each Guiberson swab and cup. No matter what type of production .. shallow or deep .. light or heavy loads .. smooth, rough or tight tubing .. you will pull more fluid with Guiberson swabs and cups. Regardless of your swabbing problem, you can meet it .. solve it .. quicker and cheaper with a Guiberson swab.

Cups are compounded to Guiberson's exclusive formulas for maximum resistance to oil .. acid .. abrasion.

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Taken individually, the savings you get from any of these Mission pump parts is substantial. But when used together, savings pyramid and down time is drastically reduced. Here's why: each of the Mission parts is the best of its kind that can be made. Mission engineering, Mission quality control, and Mission's experience and research in pumping drilling fluids have seen to that. The truth is that a Mission piston works better and lasts longer in a Mission liner that is specifically made for it. Liners also last longer with Mission pistons because the fabric back of piston rubbers reduces the danger of serious scoring or fluid cutting. So . . . don't just half save. Use only Mission parts on all your pumps. Save all the way.

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SHOWCASE . . .

New Equipment

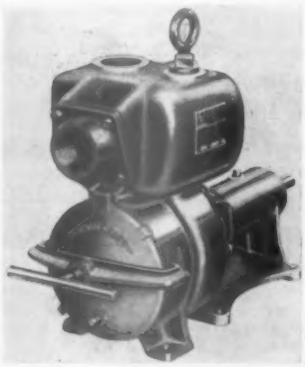
Newest valve

. . . for christmas trees or flow-line service is this through-conduit Flo Seal gate valve which, the maker claims, seals positively with line pressure and cuts wear and sanding problems as compared to older valves. The valve uses pressure in the line to keep a tight metal-to-metal seal between the floating seats and the gate. Thus, as long as pressure is maintained, the valve stays tight.

According to the maker, the full-bore, through-conduit design offers no restriction to flow, and installation can be made with pressure on either side.

The seats are self-aligning and automatically compensate for distortion caused by temperature changes, pressure changes, and wear. Two O-rings prevent foreign matter from obstructing the free action of the piston. When body pressure exceeds line pressure because of high ambient temperature, the upstream valve seat is forced open and excessive pressure is bled back into the line.

To resist corrosion and erosion, the valve seats and gate are made of alloy steel. If they need replacing, it can be done with a screw driver, the maker says. Source: **Alco Products, Inc., Petroleum Industry Equipment Div., Bank of the Southwest Building, Houston.**



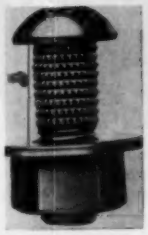
Solids-handling pump

. . . just put on the market, the Model 12B2, is a self-priming centrifugal type with a 2-in. suction and discharge.

According to the manufacturer, the impeller is so designed that it permits passage of spherical solids with diameters to 1⅛ in. The pump mounts high and dry with only the suction in a sump. One advanced feature that is expected to prove especially valuable is a removable end plate that permits fast and easy inspection and maintenance. Too, the wearplate is renewable.

The pump capacity ranges from 40 to 220 g.p.m. Delivery time: immediate. Approximate price, f.o.b. factory: $330 on base. Source: **Gorman-Rupp Co., 305 Bowman Street, Mansfield, Ohio.**

Construction costs



. . . can be cut in refinery, warehouse, and pipeline bridge construction with a new high-strength bearing bolt now on the market for structural uses, according to the maker. Designed and produced by Lamson & Sessions Co., the threaded fastener is said to combine the desirable features of a hot-driven rivet and a standard high-strength bolt.

"FLOLIGHT" DERRICK LIGHTING SYSTEMS

"FLOLIGHT" the quality derrick lighting system that requires no extra components.

When your drilling rig is equipped with a "Flolight" vaportight lighting system, you have a complete lighting arrangement. All motor leads, dog house lights, pump lights, etc., are included. There's nothing extra for you to buy.

"Flolight" systems are built specifically for drilling rigs, as a result you get more usable light for every dollar you invest. Each "Flolight" is mounted on a neoprene shock absorber that protects lamp filaments from breakage; eliminates the swaying of light fixtures in high winds. Light fixtures are constructed of aluminum alloy throughout, there's no enamel to chip, crack, or rust. Extra heavy, high temperature Pyrex lenses do away with cumbersome guards.

"Flolight" vaportight lighting systems are sold through supply stores everywhere.

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- lumber and building products
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- canneries
- glass plants
- oil field equipment and servicing and others available on request.

REACH the growing Western Canadian market by utilizing the skills and facilities already well established in Alberta.

TAKE ADVANTAGE of on-the-spot representation . . . men who have a full knowledge of Western Canadian markets and production.

AVOID costly shipping charges by having part of your product manufactured or assembled in Alberta, the growing industrial center of Western Canada.

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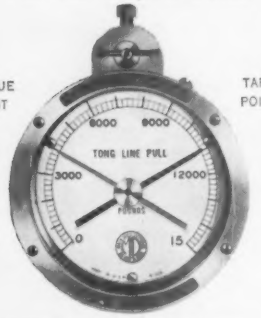
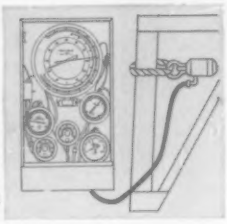
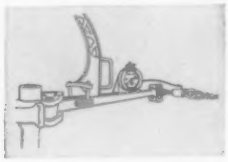
TONG TORQUE ASSEMBLY
For All Connections





PERMANENT INSTALLATION
The cylinder attached to the back-up line provides torque indication each time collars are run.



PORTABLE INSTALLATION
The torque assembly attached to the tong itself can be used for spot checks on two or more rigs.

ONE GAUGE for torque measurements of all size drill collars, drill pipe, tubing and casing.

ACCURATE AND RELIABLE readings with calibration checks seldom required.

CARE AND MAINTENANCE can be capably done by the drilling crews.

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Rows of specially formed knurls mark the shank between the bolt head and the threaded section. The knurls are set into the shank in a spiral pattern to reduce the driving load and to produce a body-bound fit when the fastener is driven or wrenched into place. As the bolt is driven, the knurls form round-bottomed grooves in the walls of the bolt holes. The maker claims that cold work induced by this grooving action offsets any notch effect. The bolt head is shaped like a driven rivet to permit driving with conventional tools. The maker reports that field tests indicate one man can easily install the fastener as compared to four men for hot riveting. Source: **U. S. Steel Corp., 2306 Gulf Building, Houston 2.**

•

Pressure measured

. . . and transmitted by a new device now available, the Model 231 indicating transmitter. It can be located to provide pressure indication at the point of measurement or within 300 ft. on an easy-to-read dial. The same unit can simultaneously transmit the pressure measurement electrically to any of the maker's remote-located recorders or indicators. Thus, with this combination, pressure indication can be located at the point of measurement of the process and it can be recorded and indicated on a panel board or control center at a distant location.

The instrument can be used to measure pressure or draft, and differential pressure of flow of air or noncorrosive gases at ranges from 0-0.2 to 0-120 in. water and for static pressure up to 65 psig. The only piping connections are to the unit. The only wiring connections needed consist of three-wire transmission to the remote receiver. Details are given in Publication 59-B231. Delivery: 8 weeks. Approximate net price, f.o.b. factory, is $140. Source: **Hays Corp., Michigan City, Ind.**

•

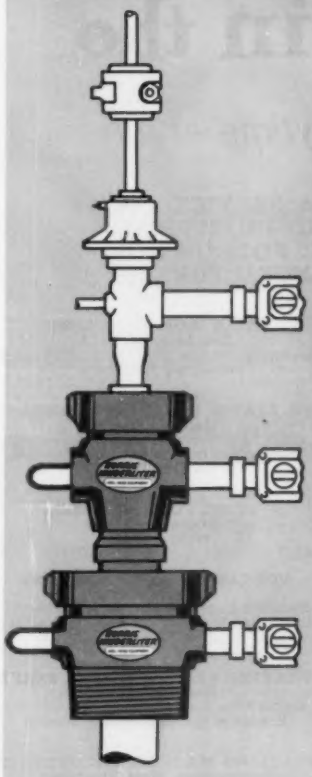
Low-cost hydrogen

. . . source of high purity obtained from dissociated ammonia is offered by a hydrogen palladium diffusion purifier now being built. The maker claims that impurities are so low that they cannot be detected by any known methods of analysis.

Operating on the principle of hydrogen diffusion through palladium, the machine produces about 70 cu. ft. of ultrapure hydrogen from every 100 cu. ft. of ammonia gas fed in. About 93% of the hydrogen in dissociated ammonia is said to be diffused as purified gas. The gas does not contain any measurable traces of nitrogen, inert gases, hydrocarbon, water vapor, sulfur, or other contaminants usually found in commercial cylinder hydrogen.

Production costs are roughly one-third more than the cost of producing dissociated ammonia. While savings

Engineered Simplicity



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vary with hydrogen use, the maker says that in most cases they will be substantially enough over a 1-year period to cover the cost of equipment, installation, maintenance, and depreciation. Delivery: 8 to 14 weeks, depending upon purifier size. Approximate price, f.o.b. factory, ranges from $2,275 for a unit with a flow rate with maximum pressure differential of 5 cu. ft. an hour up to $35,025 for one of 1 M.c.f. per hour. Source: **Engelhard Industries, Inc., 113 Astor, Newark, N. J.**

•

Rotameter

. . . just disclosed is designed for air-signaling fluid rates of flow to remote-located recorders and controllers. An important feature of the pneumatic transmitting rotameter is the ease with which it can be calibrated. Four calibration adjustments permit accurate field recalibration when basic operating conditions change. No cams are used in the adjustments. Another feature is a magnet design that provides an evenly distributed magnetic field without drag on the metering float, according to the manufacturer.

The Model 58 transmitter is a "position balance" type which gives a high degree of accuracy. The per cent scale on the transmitter case is suitable for any calibration. Details are given in Bulletin 18N. Delivery time: 4 weeks. Prices f.o.b. factory, start at about $350. Source: **Shutte & Koerting Co., Cornwells Heights, Bucks County, Pa.**

•

Temperature control

. . . with a new idea is this Model 8251-203 Unichannel on-off thermistor temperature controller. Except for the tubes and relay, all circuitry is

completely encapsulated in epoxy plastic to provide high reliability and ruggedness of trouble-free operation under conditions of shock and vibration.

The control comes with an anticipating section for close control and with a load relay rated at 25 amp. and 230 volts. The small box is suited for wall mounting, and the entire unit unmounts from the box for ease of wiring.

Two standard temperature ranges are available—200° to 600° and 0° to 200° F. List price of the control, complete with anticipating section, thermistor-sensing element, and load relay and enclosure, is $106. Source: **Electronic Processes Corp. of California, 436 Bryant Street, San Francisco 7.**

1,500 g.p.m. pumped

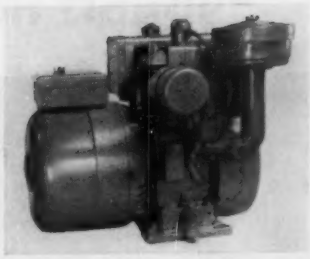
. . . at 20-ft. head with a new compact canned pump recently put into production, the Dynapump Model 670 E. The pump is designed to provide compact yet leakproof pumping for such fluids as solvents, refrigerants, and other difficult fluids. All wetted metal parts are of stainless steel. The rotor, shaft, and impeller form a single assembly enclosed in a stainless-steel cylinder, eliminating the need for a stuffing box or mechanical seal.

Pumped fluid circulates in the rotor chamber and acts as a bearing lubricant and motor coolant. Suitable for pressures up to 150 psi. and temperatures up to 220° F., the pump is available for operation on either 115 or 220-volt, single-phase, 50 or 60-cycle a.c. power. Automatic overload protection is provided. Delivery: immediate. Approximate list price, f.o.b. factory, is $55. Source: **Dynapump Div. of Fostoria Corp., Box 35-5, Huntington Valley, Pa.**

Two a.c. voltages

. . . obtainable from a new self-contained electric generating plant just put on the market, the Model 41-BHS. According to the manufacturer, the plant will deliver its full capacity in either 110 or 220-volt a.c. Two separate but convenient receptacles are provided, one to deliver full capacity at 110 volt a.c. and the other full capacity at 220 volt a.c. Capacity is 2,500 watts.

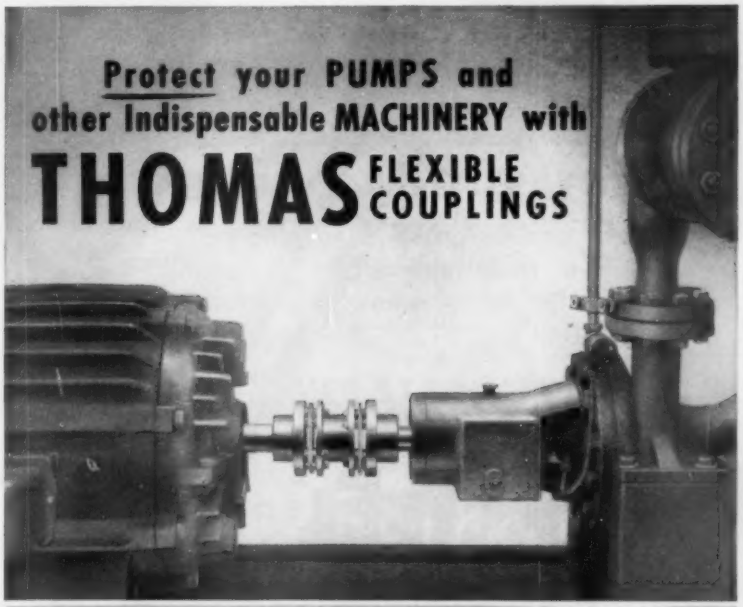
The dual-voltage plant is expected to prove useful in construction work where both 110 and 220-volt a.c. power is encountered. Delivery: 15



days. Approximate price, f.o.b. factory, ranges from $470 for a manual-starting model up to $535 for a remote-control-starting model. Source: **Universal Motor Co., 420 Universal Drive, Oshkosh, Wis.**

Protect your PUMPS and other Indispensable MACHINERY with

THOMAS FLEXIBLE COUPLINGS



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Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings. These all-metal couplings are open for inspection while running.

They will protect your equipment and extend the life of your machines.

Properly installed and operated within rated conditions, Thomas Flexible Couplings should last a lifetime.

UNDER LOAD and MISALIGNMENT ONLY THOMAS FLEXIBLE COUPLINGS OFFER ALL THESE ADVANTAGES:

- Freedom from Backlash
- Torsional Rigidity
- Free End Float
- Smooth Continuous Drive with Constant Rotational Velocity
- Visual Inspection While in Operation
- Original Balance for Life
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WARREN, PENNSYLVANIA, U.S.A.

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Yellow Strand "POWERSTEEL"®

In these days of deeper wells and faster line speeds, it pays to equip your rigs with Yellow Strand "POWERSTEEL" rotary drilling lines. Here's a built-in ruggedness to combat the shock, strain and wear of today's tough drilling . . . giving you maximum ton-mile service. "POWERSTEEL" rotary lines are made from wire having the highest tensile strength and wear resistance of any Broderick & Bascom wire rope. You gain the safety and assurance of high reserve strength, too.

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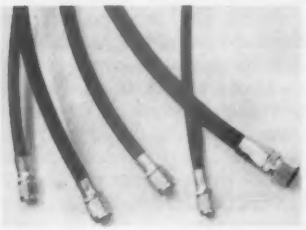
BB902

SHOWCASE . . .

New Equipment



Thinner wall hose

. . . with lighter weight and the equivalent burst strength of rubber hose is now available. Termed Nylaflow pressure hose, it weighs one-fifth that of rubber hose and has a wall thickness less than one-half of rubber hose, the maker reports. The hose comprises a nylon inner tube reinforced with high-tensile-strength yarn.

According to the maker, the hose exhibits outstanding resistance to flexing, pressure pulses, and vibrational fatigue. And it is unaffected by flammable and nonflammable hydraulic fluids. Freon permeability is reportedly about one-tenth that of rubber hose. The hose is also a nonconductor of electricity, and it can operate constantly in temperatures up to 200° F. and intermittently in temperatures as high as 300° F. Two types of the hose are available with recommended maximum operating pressures of 1,250 and 2,000 psi. Inside diameters range from ⅛ to ½ in. Delivery: immediate. Approximate price, f.o.b. factory, in lengths of 100 to 249 ft. ranges from $0.36 per ft. for ⅛-in. i.d. to $1.08 per ft. for ½-in. i.d. Source: **Polymer Corp. of Pennsylvania, 2140 Fairmont Avenue, Reading, Pa.**

●

New fuel additives

. . . available now, designated Tolad, come in two types, an inhibitor or preventive type and an inhibitor-dispersant type. The inhibitor type is usually most effective for fuels intended for use in domestic-heating units or where maximum reduction of insoluble residue and sludge is of prime importance.

The inhibitor-dispersant type is usually preferred for diesel fuels. According to the maker, this type of additive, besides reducing the quantity of insoluble residue, also reduces the residue particle size. Delivery time: immediate. Approximate net price, f.o.b. factory, ranges from $3 to $4.65 per gallon. Source: **Tretolite Co. Div. of Petrolite Corp., 369 Marshall Avenue, St. Louis 19.**

Reduce Explosion Danger In Processing Operations

JZ INERT GAS GENERATORS

The only units designed and manufactured by burner specialists to eliminate the hazards common to inert gas generating.

MAXIMUM BURNER STABILITY FOR MAXIMUM SAFETY

- **Wide Turn-Down Ratio**
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Combustion chamber is designed to minimize the formation of partially oxygenated and corrosive compounds

SIMPLE . . . RUGGED . . . COMPACT

The John Zink inert gas generator is so compact it requires less floor space than any other comparable unit.

Flanged components are used throughout for easy servicing. Each part may be removed without interfering with any other part.

The easy, economical way to provide maximum safety and efficiency for your plant and personnel in purging, storing, conveying and controlling in a variety of process operations.

WRITE FOR BULLETIN G-59

John Zink COMPANY

4401 S. PEORIA TULSA, OKLAHOMA

SHOWCASE . . .

New Literature

Paraffin-scraper

. . . plunger brochure describes basic applications, construction features, typical installations, and operation. Illustrated 4-page Brochure 14-02 presents general specifications of accessory diaphragm motor valves and timers, plus detailed specifications of the lubricator and subsurface-plunger assembly. Source: **Macco Oil Tool Co., Inc., P. O. Box 7288, Houston 8.**

Principal products

. . . made by a West German firm are shown in a new leaflet, which includes three types of steam turbines (200 kw. up, Kohler design), compressors in the 200 to 2,500-hp. range, and transport-conveyer-lifting machines. Source: **Mannesmann-Meer, N.-Gladbach, Germany.**

Automatic reels

. . . for hose and cable are described in a new folder just issued. Styles and types are shown for single and dual hose and cable application. The reels coil up hose and cable by spring action when work is stopped, the literature reports. It adds that they can be mounted on floor, wall, or ceiling, or on mobile installation, and are adjustable in any desired position when not in use. Source: **United Specialties, Inc., P. O. Box 698, El Dorado, Ark.**

Insulation-blankets

. . . technical bulletin which contains results of thermal tests recently conducted has been made available. Four-page Bulletin 6109 lists the thermal conductivity (K values) of various metals, insulating materials, and other miscellaneous materials such as air, gases, and rubber.

It also explains a simple method of calculation, especially useful in determining both the thickness and kind of material to be used in insulation of a given part and the amount of heat necessary to maintain any specified bulk temperature of that part. Source: **Electrofilm Technical Service, 7116 Laurel Canyon Boulevard, North Hollywood, Calif.**

Ventilating

. . . equipment is detailed in a new booklet, which includes Rigivin (rigid vinyl) and Rigidon (reinforced plastic) collecting hoods, ducts and stacks, elbows, and other fittings. Consisting of 20 pages, Bulletin B-500 offers sizes, specifications, and chemical-resistance data.

The publication should enable you to lay out a completely corrosion-resistant system for handling corrosive fumes—using conventional parts—and install the equipment with your own maintenance men or through a local contractor. Source: **Heil Process Equipment Corp., 12901 Elmwood Avenue, Cleveland 11.**

Industrial-tracers

. . . catalog describes the uses of tracers in the industry. The 28-page publication, currently available, is being offered to interested parties free upon request. Source: **Tracerlab, Inc., 2419 South Boulevard, Houston 6.**

Rotameter selector

. . . aid now ready for distribution (8-page Bulletin 110) states the basic advantages of variable-area flowmeters and displays various types of meters in specific areas of application. This in turn is tied into a logical development of accessories which make the rotameter adaptable to modern instrumentation. Source: **Brooks Rotameter Co., Hatfield, Pa.**

Equipment catalog

. . . of 128 pages also serves as a guide to math, science, and optics. It's packed with hundreds of items of production, laboratory, and quality-control equipment; engineering and technical instruments; optical apparatus and parts; and mathematical and scientific books and training aids.

The new publication—yours free upon request—offers a wealth of information on measuring magnifiers, pocket comparators, illuminators, projection sets, and many other instruments and components for cutting costs and speeding work in checking, measuring, and comparing.

Also included are many types of microscopes, telescopes and accessories, lenses, prisms, wedges, and hand and pocket spectroscopes. Source: **Edmund Scientific Co., Barrington, N. J.**

Ultra-V-drive

. . . Bulletin 9102 gives 36 pages of information on a drive which is said to reduce over-all drive dimensions by as much as 50%, save up to 25% in weight, and save up to 30% in cost over conventional V-belt drives. The bulletin includes drive-selection tables for stock and nonstock sheaves, horsepower tables, nomograms for service-level comparisons of drive costs, sheave and belt specifications, bushing and keyseat specifications, installation instructions, and information on how to check drive tension. Source: **T. B. Wood's Sons Co., Chambersburg, Pa.**

X-Y recorder

. . . literature piece gives complete data on a new large-scale (24 by 36-in.) recorder offering direct differential transformer or a.c. transducer input. A new circuit extends advantages of accuracy (0.1%), large-scale readout, and direct a.c. input.

Bulletin 794-1 features the recorder's vacuum holddown, changeable multicolor traces, and precision attenuators. Variations allow internal signal excitation and d.c. transducer input.

The 2-page literature offers descriptive data, typical uses, technical data, and a functional block diagram. Source: **Houston Instrument Corp., P. O. Box 22234, Houston 27.**

Glasteel pipe

. . . which is field-cut is described in a new bulletin available free upon request. It explains four simple steps in installing the pipe: (1) cut pipe to length; (2) thread; (3) fire-polish pipe end to obtain a smooth surface; and (4) finish end with belt sander to obtain a flat gasket seat and sealtight flange connection. Eight-page Bulletin 989 lists advantages as low initial cost, less-detailed piping layouts, easier modification of existing piping, and inexpensive maintenance. Source: **Pfaudler Co., 1108 West Avenue, Rochester, N. Y.**

Shell-and-tube

. . . heat exchangers are detailed in new 16-page Catalog 1258A. It presents data on 1, 2, and 4-pass models for cooling water and oil in fresh or sale-water applications, as well as specially engineered heat exchangers for heating or cooling liquids and gases.

The publication lists tables showing pressure ratings and material specifications for steam-service heat exchangers. Construction features, model identification, and a six-step set of instructions explain the selection of heat exchangers. Also included is an oil-viscosity graph, a table of weights and dimensions, and product guarantees. Source: **Young Radiator Co., Racine, Wis.**

▶▶▶ Equipment Men Notes

B. J. Travis, J. L. Ward named

. . . as district engineer at Midland and field representative at Odessa, respectively, of U. S. Steel Corp.'s Oil Well Supply Division. The report was made by William Miskimins, central-midwest area manager of the division.

Travis was employed by Oilwell in 1952 as a junior engineer at Odessa. He was appointed district engineer of machinery and equipment at that location in 1954, and in 1957 was transferred to Midland, where he is now located.

Ward began with the division in 1941 at Odessa. He left the firm the following year, but returned in 1952. He has been at Odessa since that time.

T. R. Fullinwider is elected v.p.

. . . of domestic sales by Mission Mfg. Co.'s board of directors. He has been with the company for 12 years.

Fullinwider joined Mission as field representative for the southwest district with headquarters in Corpus Christi, Tex. He then was assigned to Houston as assistant oil-field sales manager. He was promoted to oil-field sales manager, and in 1957 was named domestic sales manager.

Jones & Laughlin Supply forms

Bill Wood

. . . a central region with responsibility for all sales activities in Kansas and Oklahoma. Bill Wood, former manager of the Tulsa city sales office, has been appointed regional manager, according to W. L. Wolfe, vice president of sales.

Wood joined J&L as a salesman at Natchez, Miss. in 1952. He was assigned as city salesman at New Orleans in 1955 and was promoted to assistant district sales manager at Wichita Falls, Tex. in 1956. Wood became manager of the Tulsa city sales office 3 years ago.

Tex-Tube names Art Morton

. . . manager of quality control. Morton joined the Houston-headquartered firm more than a year ago as tubular-products engineer.

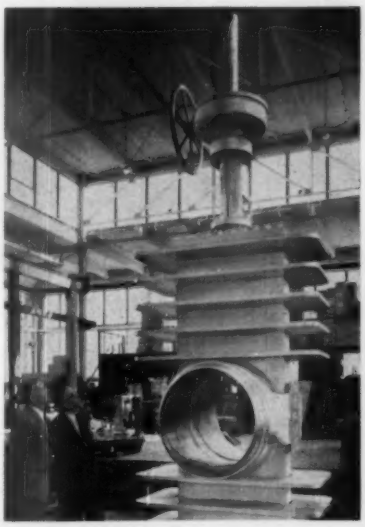
Morton was with Allis-Chalmers Mfg. Co. in Wisconsin between 1948 and 1949. From 1949 through 1955 he headed his own engineering firm which operated in the Rocky Mountain area. In 1959 he joined Garrett Oil Tool Co. as supervisor of the equipment development section with headquarters in Longview, Tex.

Name change is announced

. . . by Food Machinery & Chemical Corp. for its Peerless Pump Division and seven associated operations in pump manufacturing and allied fields. Peerless Pump and its operations will now function under the organizational name of Hydrodynamics Division.

Gerald F. Twist, FMC vice president in charge of the Hydrodynamics Division, said the name was adopted to provide a higher degree of recognition in identifying the various manufacturing and marketing groups comprising the former Peerless Pump Division.

Under the divisional name, individual operations will retain their separate identity through product-line designations such as: Peerless Pump, Chicago Pump, Coffin Turbo Pump, Mechanical Foundries, Sonith Foundries, Laval Underground Surveys, Varley-FMC, Ltd. (England), and Peerless-Tisa, S. A. (Mexico).



HUGH GATE VALVE of Grove Valve & Regulator Co. is 18-ft. tall and weighs about 14 tons. President Marvin Grove, left, and Vice President George Doty look over the G-4 valve—the type to be produced at Grove's newly converted plant in Longview, Tex. The valve, used in pipelines to control flow of natural gas, is rectangularly shaped to reduce body cavity. It's equipped with special ribbing to meet pressure requirements.

Worthington directors appoint

. . . three commercial vice presidents — W. C. Cheek, H. W. King, and W. J. Van Vleck. Cheek joined the Harrison, N. J. firm in 1920. He was appointed manager of the Chicago district sales office in 1945, then became midwest regional sales manager in 1957.

W. C. Cheek

H. W. King

W. J. Van Vleck

King, now western regional sales manager, started his career with Worthington in 1923. He was a salesman in Kansas City and Seattle, then manager of the San Francisco district sales office from 1949 to 1952.

Van Vleck, promoted from manager of the New York district sales office to commercial vice president and eastern regional sales manager, joined the corporation in 1924. He was appointed manager of the Atlanta district sales office in 1944 and became New York district office manager in 1952.

Dowell Division promotes

. . . Gulf Coast personnel. L. D. (Jack) Boughton, former manager at Lafayette, takes over as district engineer in New Orleans where he will supervise Dowell's engineering work on the Gulf Coast. He will also supervise field research work and act as liaison between the district field offices and the company's research department in Tulsa.

J. O. Hendrick has been promoted to manager at Lafayette where he will supervise all sales and service activity. B. J. Ladd, for many years in charge of sales at Houma, has been promoted to district sales engineer and transferred to the New Orleans headquarters. J. C. Phillipi has been transferred from Lake Charles to Lafayette as area sales engineer, working in the Morgan City-Lake Charles area.

Nolan Pierson, former service engineer at Hattiesburg, is now sales engineer at the Lafayette oil-center of-

fices. Ed Dronette and J. E. Herbst, former service engineers, have been promoted to sales engineers at Houma. Recently promoted to service engineers are L. T. McFarlin, Lafayette; T. L. Morris and R. J. Boudreaux, Houma, and R. C. Jaynes, Hattiesburg.

W. E. (Bill) Esslinger becomes

W. E. Esslinger

. . . sales manager for Skinner Brothers Co., Dallas-Tulsa equipment manufacturer, according to Edward T. Skinner, the firm's general manager. Before joining Skinner, Esslinger was sales manager of Hale Mfg. Co. for 2½ years. Prior to that, he was manager of the National Supply Co. outlet at Madison, Kans., for 6 years.

Southern Engine & Pump opens

. . . a branch office in Shreveport, and appoints Sepco-Shreveport distributor for ROIline (formerly Le Roi) and Deutz engines, also to carry a complete line of centrifugal and rotary pumps. The new office offers Sepco's own Southern packaged-gas-compressor units and maintains a complete service and parts department. E. W. Boswell, former manager of Southern Engine's Kilgore, Tex. office, is manager of the new branch. Sepco's home office is in Houston.

William G. Vollendorf appointed

. . . manager of the Tulsa sales district of Fairbanks, Morse & Co. He succeeds Kirke K. Wyatt, newly promoted to manager of petroleum-industry sales for Fairbanks-Morse.

Vollendorf went to work for F-M in 1942. He is moving to Tulsa from Kansas City, where he was manager of the electrical department of the Kansas City sales branch. Wyatt has been with the company since 1945 when he became an application engineer at the firm's pump works in Pomona, Calif.

Baker Oil Tools, Inc. acquires

. . . Hayward Testing Service's cementing collars and related equipment. Hayward, a California firm, has been in business for over 25 years. Initially, Baker will market and service these products only in California.

Varec sales engineers complete

. . . a week-long series of tests following a 6-month training course, announces Frank V. Long, Sr., president. The project was designed to provide a staff fully trained in the technical complexities of electronic developments and the Verec pulse-code-telemetering system.

Varec's sales engineers throughout the country were called in to the company's headquarters for the testing operation. It was conducted as a seminar or refresher course on all technical data studied and assimilated during the preceeding 6 months. The course also included a preview introduction to several new products the company is planning to produce.

William B. Thomas is appointed

. . . regional special sales representative for the Dallas-Fort Worth area of Security Engineering Division, according to Claude L. Griffin, vice president of sales. Thomas will maintain offices at the firm's Dallas headquarters.

Having first joined Security in 1951 as a salesman in Colorado City, Tex., Thomas successively became Security district manager at Hobbs, N. M., then assistant manager of the West Texas division, before elevation to his present position.

Plastic Applicators, Inc. holds

. . . a winter conference in Houston. Twenty-seven sales engineers and executives took part in the company's program of development for 1960.

Following completion of a $400,000 expansion and automation program which has doubled plant capacity, G. J. Duesterberg, president, and Cordell Garner, vice president in charge of sales, directed the meeting which introduced details of new research and development, inspection facilities, and marketing methods.

Pictured in the front row are Garner and Duesterberg. In the second row are Harry Bozeman, Vic Hajovsky, and Pat Donnelly. Third row: Gerald Beard, Cam Murchison, and Bill Kristynik.

Crane reports decentralization

. . . of its manufacturing facilities and marketing organization. The company has been formed into five groups, each with its own manufacturing, engineering, sales, and control divisions.

The groups include: Industrial Products Group, Chicago; Plumbing-Heating-Air Conditioning Group, Johnstown, Pa.; Crane Supply Co., Chicago; Systems and Controls Group, headquarters yet to be named; and International Group, New York City.

This arrangement unites Crane Co. with the five firms that it has purchased since last September, including Chapman Valve Mfg. Co., Pipe Fabricators, Inc., Swartwout Co., National-U. S. Radiator Corp., and Canadian-Pittsburgh Piping, Ltd.

Republic Supply Co. appoints

. . . two new tubular-sales representatives—Frank Sanford, Jr. and Ralph Bartow—according to W. J. McWilliams, president of the Oklahoma City firm.

Sanford, who will work in Houston, is a former employe of Lion Oil Co. in El Dorado, Ark. He joined Republic at El Dorado in 1955 as floorman. Sanford later was a field sales representative and store manager until he was shifted to Houston in 1958 as a sales-office representative.

Bartow will serve the company in Tulsa under the direction of Don Collins, vice president. Bartow's past experience has come from Baroid Sales; National Supply Co.; Black, Sivalls & Bryson; and Pomeroy Equipment Co.

Cooper-Bessemer Corp. names

. . . Owen T. Tolson to a sales-engineer post in the Shreveport office, according to George Edick, domestic sales manager. Tolson was earlier associated with Cooper-Bessemer as a sales engineer in the Mount Vernon, Ohio, home office before joining the U. S. Air Force. Most recently, he was with Foxboro Co. in Shreveport.

Edick further announced the transfer of two men from the Mount Vernon location. R. M. Boone goes to the Odessa branch office where he will work under the immediate supervision of C. L. McDougall, Odessa branch manager, on the application and sales of C-B compressors in that area. Prior to 1957, Boone was with Herlin Engineering Co.

Richard H. Van Bergen has been transferred to the New York branch office as a sales engineer where he will work under the direction of C. J. Havekotte, New York branch manager, also on application and sales of compressors and engines. Van Bergen has been with the firm since 1956.

Sales divisions are reorganized

. . . by Parkersburg Rig & Reel Co., announces J. W. Robbins, vice president and general sales manager. New

C. E. Hall

W. J. Slaughter

divisions have been set up in Los Angeles, Denver, Calgary, Tulsa, Midland, and Dallas. Additional division offices are located in Parkersburg, W. V. and Houston.

M. L. McLafferty

C. M. Ferguson

Managers appointed to head up the divisions are: C. E. Hall, Los Angeles, California division; W. J. Slaughter, Denver, Rocky Mountain division; M. L. McLafferty, Calgary, Canadian

R. H. White

G. W. Hendricks

division; C. M. Ferguson, Tulsa, Mid-Continent division; R. H. White, Midland, West Texas-New Mexico division; and G. W. Hendricks, Dallas, North Texas-North Louisiana division.

J. M. Baldridge continues as manager of the Gulf Coast division in Houston, and L. R. Latimer retains his managership of the Eastern division in Parkersburg.

Nowery J. Smith Co. confirms

. . . an agreement with Goodyear Tire & Rubber Co. which gives Smith's Special Coatings Division the exclusive right to apply Goodyear's Plioweld in the Gulf Coast area. Plioweld is a special rubber lining and covering used to protect metals from corrosion and abrasion. Carl Roehl, Special Coatings Division manager, said that Plioweld has already proved itself in this area.

"This association with Goodyear is ideal," Roehl said. "Careful metal cleaning such as pickling or blasting precedes the application of Plioweld and metal cleaning is one of Nowery J. Smith's specialties.

J. M. Hoskinson is appointed

. . . district sales manager for the Connecticut, Southern New York, and New Jersey territory of Roper Hydraulics, Inc. He joined the Roper pump division in 1939 following 4 years with a midwestern machine-tool builder. Hoskinson held posts as design engineer, sales engineer, sales manager, and most recently, vice president in charge of sales.

Dexter Brown assumes position

. . . as sales engineer for Plastic Applicators, Inc., Houston, reports Cordell Garner, vice president in charge of sales. Brown will handle West Texas-New Mexico sales out of Hobbs, N.M.

Before joining Plastic Applicators, the newly appointed sales engineer was senior petroleum engineer with Anderson Pritchard Oil Corp., and prior to that was with The Texas Co.

W. T. (Dub) Kelley is appointed

. . . area sales manager for Milwhite Mud Sales Co., working out of the company's general office in Houston. The announcement comes from Gilbert Pollard, general sales manager. Kelly joined Milwhite's sales force in August 1958, after having worked for Twenty Grand Oil Field Service. He has been associated with the oil industry since 1936.

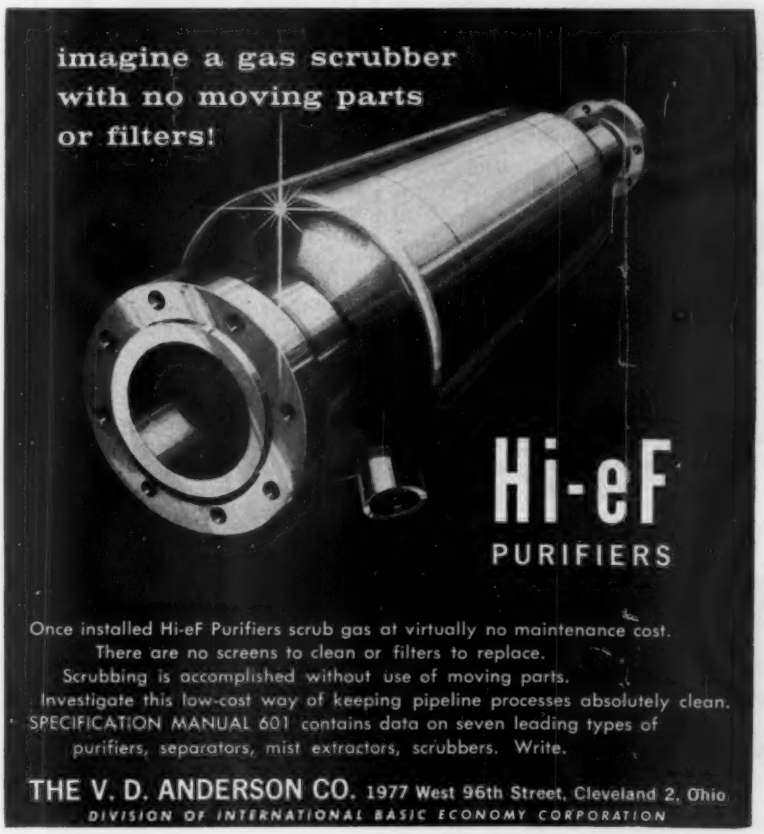
W. T. Kelly

Brown Fintube Co. appoints

. . . Lloyd A. Alaback and his newly formed Thermal Engineering Co., Tulsa, as sales representatives, announces Edward J. Skiba, executive vice president of the Brown organization.

Alaback will handle the sale of Brown Fintube heat-transfer equipment consisting of double-pipe finned heat exchangers, tank heaters, tank suction and line heaters, indirect fired heaters, and other heating and cooling equipment. His territory will include Oklahoma, Kansas, Nebraska, and western Missouri.

(Continued on page 179)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with no moving parts
or filters!
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Once installed Hi-eF Purifiers scrub gas at virtually no maintenance cost.
There are no screens to clean or filters to replace.
Scrubbing is accomplished without use of moving parts.
Investigate this low-cost way of keeping pipeline processes absolutely clean.
SPECIFICATION MANUAL 601 contains data on seven leading types of
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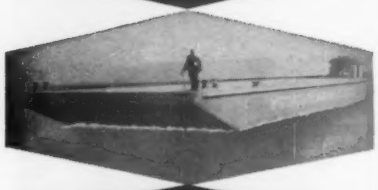

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READY TO ROLL is this Porta-Rig 5000 with a 67-ft. over-all length that moves from one location to another without disassembly.

Texas firm makes fast, portable rig

A PORTABLE RIG designed for fast, profitable well servicing and slim-hole drilling is the Porta-Rig Model 5000, built by Spencer-Harris Machine & Tool Co. of Gladewater, Tex. This trailer-mounted unit is built to conform with the limits of most highway restrictions.

This trailer is built from 12-ft., 36-lb. I-beams, with continuous-welded one-piece construction. Standard running gear is a heavy-duty Ne-Way tandem. The trailer has an over-all length of 38 ft., and a platform 30-ft. long and 7 ft. 10½-in. wide with walks extended. The trailer has an 8-ft. gooseneck equipped with standard fifth-wheel plate and king-pin.

When fully equipped with draw works, mast, ⅞-in. drilling line, rotary table, traveling block, swivel, and 165-hp. engine with torque converter, the complete unit weighs 61,000 lb. In the over-the-road position the entire unit has an over-all length of 67 ft., over-all height of 13 ft. 5½ in., and over-all width of 7 ft. 10½ in.

The entire Spencer Porta-Rig is moved from location to location without disassembly. All lines and blocks remain strung in the mast.

When moving on a new location, the rigging up is fast and simple. The 7 ft. 10½ in. by 8 ft. folding table platform is lowered and braced with adjustable screw-jack foundations. Hydraulic jacks under the trailer brace and level the entire unit. Spirit levels at the control panel simplify this job.

It is recommended that double-reinforced heavy wood ground mats be used under all foundation members and substructures for added stability and rigidity. These low-cost ground mats are available from Spencer-Harris and are equipped with cable loops for easy handling.

TWO-STAGE hydraulic ram lifts will raise the mast to full height in a few minutes. Clearance from crown block to drilling platform is 97 ft. 8 in.

A two-stage hydraulic ram lifts the mast from the horizontal traveling position to its first vertical position. The same ram is also used to lower the mast. In case of hydraulic system failure a safety device prevents any sudden drop of the mast by lowering it at a safe rate. The hydraulic pump is driven by the draw-works engine.

The hydraulic lifting operation to the first vertical position usually takes about 4 minutes. The second phase of lifting the top section to the maximum height is accomplished with the traveling block and a system of two cables. This operation also takes only a few minutes. A patented positive safety lock automatically grips each of the four legs of the upper section when it

reaches the maximum height. This safety device is unlocked from the driller's position when the mast is to be lowered.

The mast is all-welded and made of 3½-in. J-55 steel tubing and is certified to 100,000 lb., with a 2-to-1 safety factor giving it a 200,000-lb. hook load. Lattice-type construction provides ample internal bracing for extra strength and, at the same time, provides good visibility for the driller and an unobstructed working area.

When in the locked drilling position at the maximum height, the mast is 2½° offcenter and has a working clearance of 97 ft. 8 in. between the crown block and the platform floor.

If foundation structures are resting on wood ground mats, the distance from platform floor to ground is 60 in. If steel ramps are used, the clearance space between platform and ground for blowout preventer is 82 in.

When 18-in. steel ramps are used, a pipe-racking substructure is used at the end of a special interlocking rotary table platform. Standard height of this substructure is 82 in., length is 15 ft., and width is 7 ft. 10½ in. It is of one-piece all-welded construction, and uses removable hand rail. Rotary table platform fits into substructure to provide ample foundation support for added load of additional racked pipe. It will accomodate 12,000 ft. of 2⅞-in. tubing or 6,000 ft. of 3½-in. drill pipe.

Palmer rejoins Rowan

C. R. PALMER

Charles Robert Palmer returned to Rowan Drilling Co., Inc., Fort Worth, as engineer in the firm's main office. He will handle duties formerly performed by R. A. Watson who was transferred to Rowan's Gulf Coast division as assistant division superintendent in New Orleans.

Palmer initially worked for Rowan where he started as a roughneck in 1953 while attending SMU in a Co-Op Engineering Program. This program provides for students to go to school and work in alternating 2-month periods. When Palmer graduated in mechanical engineering in June 1957, he went with Rowan as a field employe working offshore. A year later he resigned to work as an engineer for an equipment-manufacturing company.

Upon rejoining Rowan last month, his duties consisted of engineering work in the company's office in the Rowan Building at 6000 Camp Bowie Boulevard.

McAlester Fuel sells rigs

THREE ROTARY RIGS have been purchased by Forster Drilling Co., Odessa, Tex., from McAlester Fuel Co.

The three rigs were used by McAlester both for contract work and drilling for its own account. They bring to 10 the number of rotaries now operated by Forster Drilling.

The rigs are a National 100, an Emsco J-1100, and an Emsco GC-500. Two of them currently are in Lea County, New Mexico, the other in Arkansas.

George W. Roach, Midland, and Guy Boyd, Lovington, N. M., both district drilling superintendents for McAlester, now have joined the Forster organization. Boyd will remain at Lovington, while Roach moves to Shreveport to direct Forster operations in that area.

McAlester officials said the firm will continue exploration and production operations in the Permian basin area, but will now contract its drilling work.

Many drillers are saving time by permanently attaching Simplex Screw Jacks to the underside of their rig floor. When the rig is to be moved, turnbuckle bracing is unfastened and jack is swung up, out of way. At new location, jack is swung down, turnbuckles attached and jack is ready to level rig. Jack can't get lost, is always available for use.

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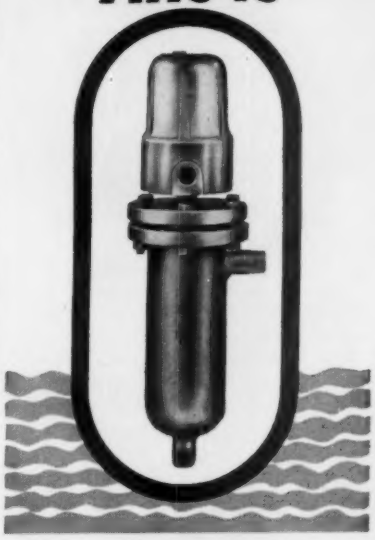

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Bethlehem Wire Rope Serves Work-Over Job in Northward Field—This is a recent work-over job by the J. C. Lewis Drilling Company on Well 15 in the Northward Field, near Wickett, Texas. The Bethlehem wire ropes were 5,500 ft of 7/8-in. 6 x 21 Type U Plow, right lay, with fibre core, and 5,000 ft of 9/16-in. 6 x 7 Formset, Purple Strand, right lay, with fibre core. As usual, the rope provided top-notch performance—one of the reasons why it's a favorite with drillers everywhere.

Bethlehem Steel Company, Bethlehem, Pa. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem Wire Rope

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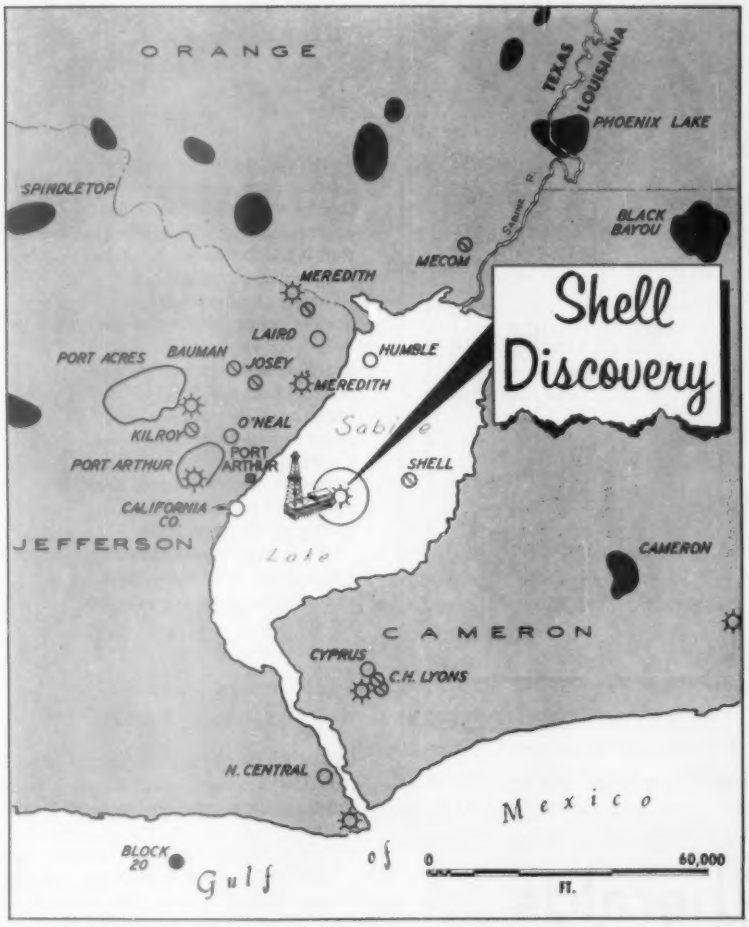


ONE OF THE MOST ACTIVE drilling programs on the Gulf Coast centers on the Texas-Louisiana state line and in eastern Jefferson County, Texas. The play now extends into the waters of Sabine Lake, where one good discovery has been completed, and five wildcats are going down.

Gulf Coast operators plunge into Sabine Lake

BY FRANK J. GARDNER

NOT ALL the offshore drilling in Louisiana is confined to the Gulf of Mexico. At the southwestern corner of the state, a 1959 discovery in the middle of Sabine Lake has led to a two-state campaign that now involves five wildcats in lake waters.

Luck in the water . . . Shell Oil Co. was first to get its feet wet here. On August 24, 1959, the company's 1 State Lease 3459 was finished on 9/64-in. choke for 141 bbl. of 44.7° oil and 2,800 M.c.f. of gas per day. It was a deep Cameron Parish operation, with perforations opposite sand of probable Oligocene age at 11,070-80 ft. Total depth was 12,091 ft., plugged back to 11,200 ft.

Prior to this, the lake bed had held very little interest for Gulf Coast operators . . . **why** is anybody's guess, for it's surrounded by rich gas and oil fields. Undoubtedly the discovery of the prolific Port Acres field to the west in Jefferson County, Texas, had its effect on eventual exploration of Sabine Lake.

Shell followed up its discovery with an offset 2,000 ft. to the northeast; this was the 1 State Lease 3460. But this one proved a shocker. It was dry at total depth 11,507 ft. on October 12, 1959. No other producers have been finished. But the operator has now announced intention to drill its 2 State Lease 3460 between the discovery and the failure. In addition, Shell is busily sinking its 1 State Lease 3464 to a 16,000-ft. target about halfway between the discovery and the eastern lakeshore.

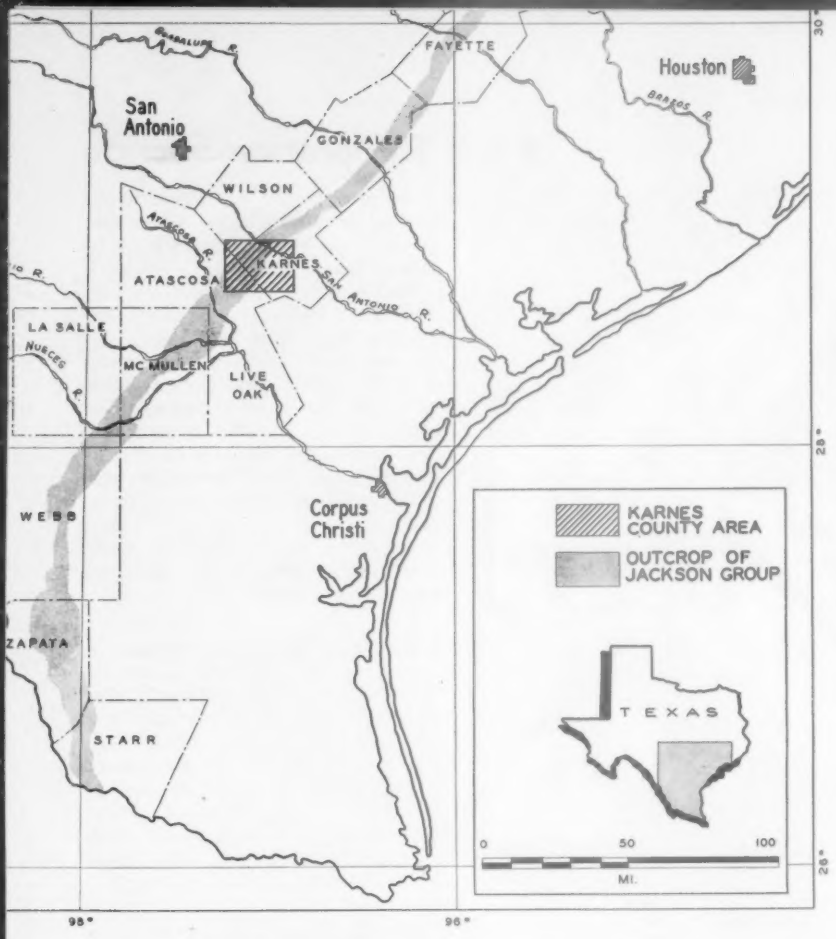
Entices new effort . . . Meanwhile, other companies have moved into the Sabine waters. The California Co., after drilling a 14,000-ft. dry hole last year at its 1 State Lease 3461, has made location for the second wildcat on the lease; this one will go to 13,800 ft. Calco has another wildcat drilling at 1 State Lease 3463; it is a 13,500-ft. test, now below 10,000 ft. Both are in Cameron Parish waters.

On the Texas side of the lake, Humble Oil & Refining Co. has announced location for its 1 Sabine Lake State Tract 8. This new wildcat lies off Jefferson County about 8 miles northeast of Port Arthur, and will seek production to 12,500 ft.

And new hopes . . . The Humble plunge into Sabine Lake is just one more facet of the extremely active (and successful) wildcat play that has enveloped the eastern part of Jefferson County. Here in the shadow of Spindletop, operators have kept their rigs whirling at a record pace. The elusive hope of finding another Port Acres or Port Arthur field has prodded the play.

Port Acres and Port Arthur lie only half a mile apart and are separated by a down-to-the-coast fault. Both produce from the Hackberry-lower Frio sand at depths of 10,000 to 12,000 ft. These are highly productive fields, with potentials up to 450,000 M.c.f. per day of gas, enriched by a condensate recovery of 50 to 60 bbl. per million.

The eastern point of Jefferson County has approached boom proportions (see map); and the search for an eastward extension of the Hackberry trend now goes under water. If it pays off as handsomely as other Gulf Coast inland water spots, it should make quite a splash in the 1960 exploration books.



MAP shows position of Karnes County area. Fig. 1.

Uranium find heralds Texas wildcat action

BY D. HOYE EARGLE
U. S. Geological Survey, Austin

These studies of the Karnes County area have barely scratched the surface of the vast storehouse of knowledge that is hidden in the materials that may be studied.

Areas of abnormal thickening or thinning of the units from regional norms, areas of abnormal strike and dip, and abrupt overlap of older beds by younger may point to structural anomalies.

Areas of change of facies from one environment to another may point to areas where stratigraphic traps exist.

These may very reasonably be explored for oil and gas accumulations, or for uranium occurences.

URANIUM was discovered in the South Central Texas Coastal Plain, near Tordilla Hill in western Karnes County, in 1944 in tuffaceous rocks of Jackson-Eocene age (Fig. 1).

Because of the rarity of this occurrence of uranium, and because the region held promise of becoming a major uranium-producing area, the U. S. Geo. Sur. initiated a program of intensive study of the geologic relations of the deposits. The project included both surface and subsurface mapping, radiometric and other geophysical surveys, and a study of the physical character of the ores and their host rocks, including their petrology and mineralogy, and the chemistry of the fluids the rocks contain.

In 1956, the new Fashing-Edwards gas field was discovered a few miles to the southwest. This field has been extended 2 miles down the dip from the uranium occurrences. The studies by the Survey have indicated that there is a possible genetic relationship between the occurrence of the sulfur-bearing gas and the deposition of the ore in tuffaceous rocks[8]. Other more recent discoveries of uranium in the Coastal Plain in tuffaceous rocks have added further evidence to the theory that the uranium was released from the tuffs by weathering in a subhumid or semiarid climate, and were precipitated in a reducing environment which may have been due to the escape of hydrogen sulfide along fault lines or other structural features.

Thus the character of the rocks, the environment in which they accumulated, and their structure and stratigraphic relations are important in the occurrence not only of the uranium deposits, but also of oil and gas. It may be more than coincidence that the new Person field in northern Karnes County is in the same area as a uranium prospect which was found several years before the oil field was brought in.

Lower Tertiary

Strata of Tertiary age cropping out in the Coastal Plain constitute classic examples of sequences of beds that reflect cyclic advances and retreats of the sea. Alternations of marine shale and glauconitic sands, with nonmarine lignitic sands are especially well expressed in the Claiborne group, Eocene, where each of the formations shows an individual stage of the sea[5].

The Jackson group, however, reflects shorter cycles that produced thin units of interbedded nonmarine sandstones, siltstones and tuffs, and marine sandstones and bentonitic

Publication authorized by the Director, U. S. Geological Survey. This article is summarized from a paper given before the Gulf Coast Association of Geological Societies at the meeting in Houston, November 12-13, 1959, and is published with the permission of the association. The article is based on work performed by the Geological Survey on behalf of the Division of Raw Materials, U. S. Atomic Energy Commission.

HALLIBURTON'S *hydra-jet*

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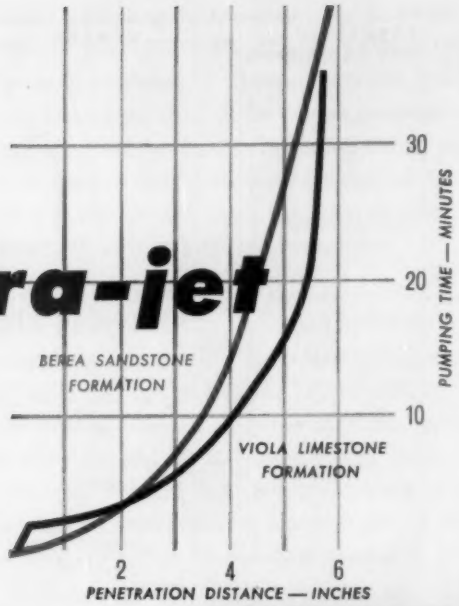

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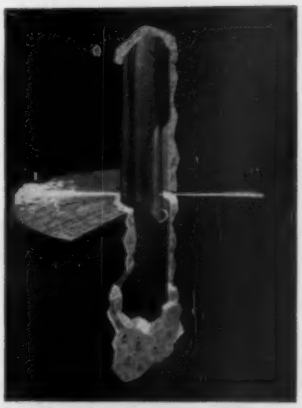
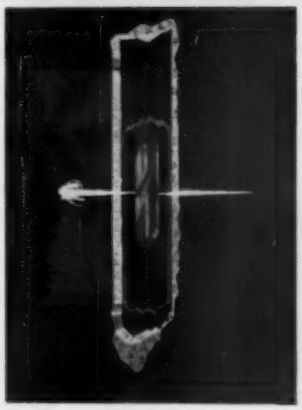


HORIZONTAL FRACTURE INITIATION . . . By running the tool to the predetermined depth and slowly rotating the tubing while jetting, the jetting fluid will ring-cut the formation either through casing or open hole to help direct the subsequent fracturing operation in a horizontal plane.

VERTICAL FRACTURE INITIATION . . . Another version of the tool may be moved up and down with the tubing while jetting, causing vertical slots to be cut on either side of the hole. This tends to direct the fracturing operation in a vertical plane.



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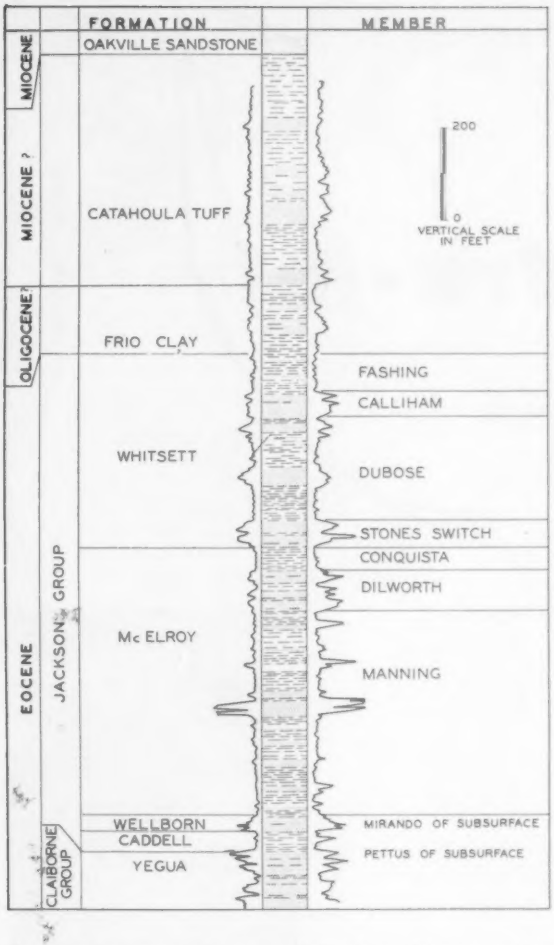


THIS column shows the stratigraphy of the respective members of the Jackson group. Fig. 2.

clays. There were three principal transgressions of the sea during Jackson time, and several shorter advances. Following this, in the Oligocene(?) to Pliocene, several units were deposited under nonmarine conditions; the Frio clay, the Catahoula tuff, the Oakville sandstone and Lagarto clay, and the Goliad sand.

The causes for the marine advances have been the periodic sinking of the land gulfward, and corresponding uplift of the land some distance inward. The land was tilted gradually, which caused, with each tilt, an advance of the sea inland. Reworking of materials over which the sea advanced produced unconformities between the sediments which were transgressed and those being deposited in the transgressing area.

In most advances or retreats of the sea, sediments gradational from nonmarine to marine were deposited as littoral, estuarine or offshore bar deposits. Following each invasion of the sea, filling-in of the margins of the sea pushed the coast line outward and the marine deposits were covered by nonmarine sediments. Generally such structural movements were gradual, and in the Claiborne and Jackson of South Central Texas, to which area this article specifically applies, there were few, if any, long breaks in sedimentation.

Changes from nonmarine to marine conditions were gradual and sedimentation is believed to have continued in this region most of the time. The coastal and shallow sea-floor topography was probably in many ways similar to that of the present Texas coast and shelf, though with not quite so much relief, during the Eocene and Oligocene, but with, perhaps, as much relief as the present coastal topography during the later Tertiary.

The Jackson Group

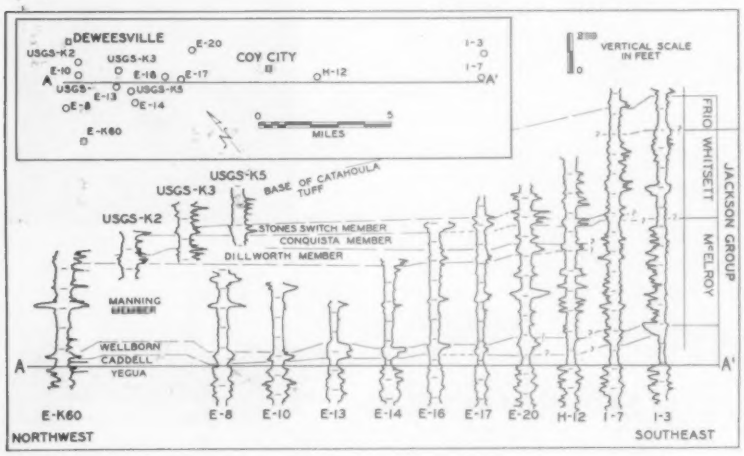
Fig. 2 shows a composite electric log of wells in the northern and central parts of Karnes County, from the surface to the base of the Jackson group, divided into the stratigraphic units used in mapping the Karnes County area[2]:

1. Caddell formation is transgressional marine, consisting of glauconitic fine sand and carbonaceous clay on the outcrop, with calcareous concretions and banks of oyster shells at its base, which lies on sands of the Yegua formation, called the Pettus sand by subsurface geologists. In the subsurface the Caddell is chiefly clay containing the foraminifer "Textularia dibollensis."

2. Wellborn sandstone is a regressional near-shore shallow-marine or lagoonal deposit. It is a tuffaceous, faintly crossbedded, or wave-rippled fine sand.

3. McElroy formation is divided into the nonmarine to shallow-water marine Manning clay member at the base, which is a thick unit of bentonitic clay, tuff, and tuffaceous sand; the Dilworth sandstone member, chiefly marine fine sand; and the Conquista clay member, formerly the Falls City shale[3], carbonaceous marine clay containing a few thin fossiliferous beds of sandstone. The McElroy characteristically contains the foraminifers "Textularia hockleyensis" and "Massilina pratti."

4. Whitsett formation, composed chiefly of sands and sandstone near



ELECTRIC-LOG correlations across western Karnes County. Fig. 3.

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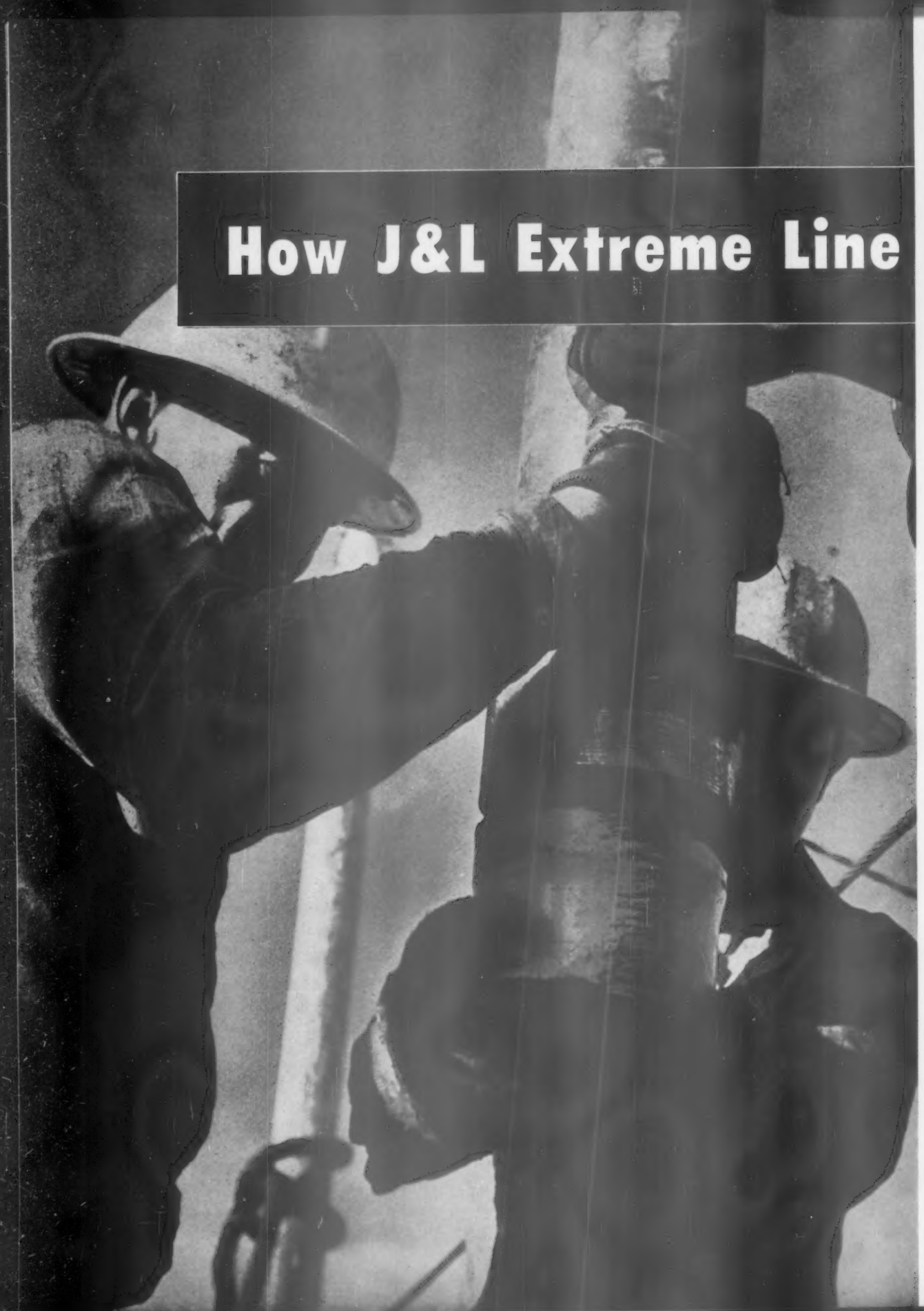
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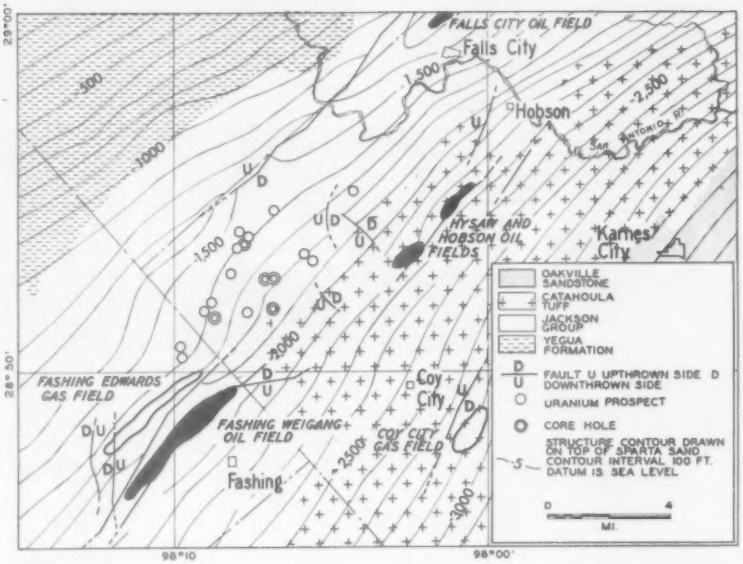
the bottom, and tuff and bentonitic clay toward the top. It consists of four members, in ascending order: Stones Switch sandstone member, shallow-water marine sandstone; the Dubose member, of tuff, tuffaceous sand, and bentonitic clay with one marine sandstone unit called locally Tordilla sandstone, which supports the topographically prominent Tordilla Hill in the uranium district of western Karnes County; Calliham sandstone member, in Live Oak and McMullen counties, shallow-water marine sandstone; and Fashing clay member, marine clay containing the foraminifer "Nonion whitsettensis," fossil coquinas of "Corbula" and "Ostrea," and beds of fine-grained tuff near the top.

On the outcrop, the poorly exposed Frio clay of Oligocene (?) age overlies the Jackson conformably, and is exposed as far northeast as northern Live Oak County. Northeast of northern Live Oak County, near the Atascosa County line, the Catahoula tuff of Miocene (?) age overlaps the Frio, and in the vicinity of Fashing assumes an abrupt change in strike to the northwest to overlap also more than 100 ft. of the Whitsett formation of the Jackson. Northeast of the vicinity of Tordilla Hill the Catahoula again assumes a northeast strike, although the overlap continues for many miles. In northern Karnes County, where the overlap is believed to cease, about 200 ft. of the Whitsett is overlapped. In the subsurface of central and southern Karnes County, the Frio forms a wedge between the upper part of the Jackson group and the overlapping Catahoula tuff. It is in this area of strong overlap of the Whitsett formation north of Fashing, in the vicinity of Tordilla Hill, that the principal uranium deposits in beds of Jackson age, as well as the newly-discovered large Fashing-Edwards gas field, are located.

The correlation of the units of the Jackson (Fig. 3) is shown from coreholes along the outcrop in Western Karnes County, southeast to areas of exploration for oil in central Karnes County. It also shows the extent of overlap by the unconformably overlying Catahoula tuff.

The tuffaceous sediments of the Jackson are believed to have resulted from extensive volcanic activity far to the west, perhaps chiefly in northern Mexico, but also as far north as the Davis Mountains of West Texas[7]. This material is presumed to have been deposited on the land surface in the provenance of these deposits, was picked up and brought to the coastal areas by streams; the coarser-grained and some finer-grained material was



THIS MAP depicts areal geology and structure contours in the Karnes area. Fig. 4.

deposited in bays and swamps near the coast and the clays were washed out to sea.

The nonmarine and near-shore deposits consist of not only tuffaceous crossbedded sandstones and bentonitic clays, but also beds of tuff which contain much organic matter and which accumulated in swamps directly from ash falls. These beds weather to white, fissile, layered tuff, light in weight and containing many flattened reed-like plant impressions. Much silicified wood is present in some beds; much of it is opalized with silica that has been released from the tuff by weathering.

Structure

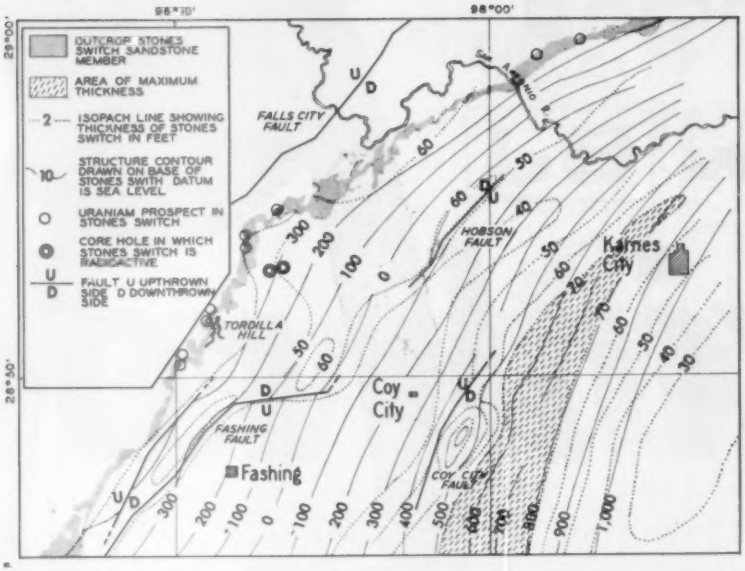
The map, Fig. 4, contoured on the top of the Sparta sand (Claiborne group), shows the general strike of the rocks and of the faults in the Karnes County area. The major faulting trends northeast, nearly parallel to the strike of the rocks.

Two principal fault systems affect the outcrop of the Jackson in the Karnes County area, the Falls City fault in the northern part of Karnes County, downthrow to the southeast, and southwest of its terminus, and "en echelon" to it, the main Fashing fault downthrown to the northwest. The Tordilla Hill area of western Karnes County lies between the ends of these two major faults, a distance of about 6 miles. The Tordilla Hill area is thus a warped block of gentle dips between the ends of the two en echelon faults which are displaced in opposite directions. In this area the rocks of Jackson age assume a strike locally of about N. 5° W., and are strongly jointed. On the crests of the cuestas the sandstones are highly silicified, but down the dip the sands are soft and little resistant, and the volcanic shards they contain are well preserved.

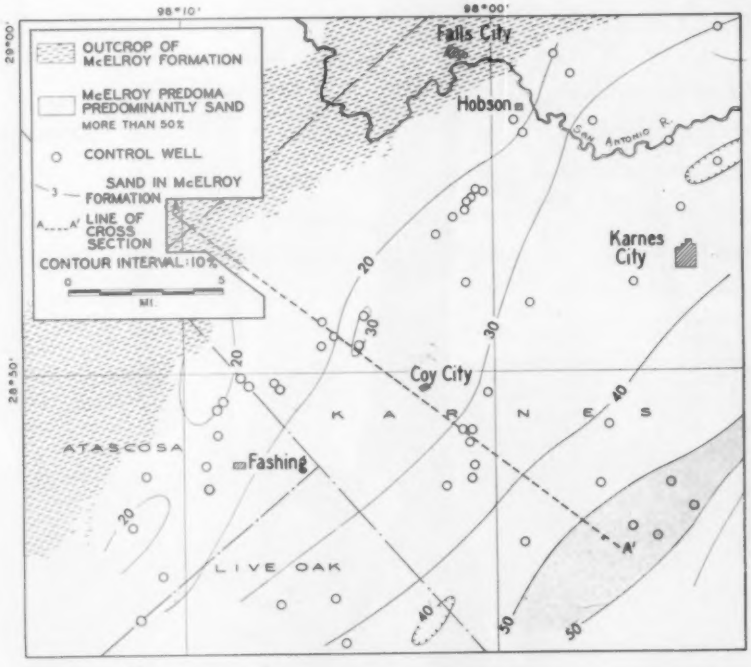
The throw of the Falls City fault is not accurately measurable on the surface, but is believed to be between 50 and 75 ft., as indicated by the stratigraphic displacement of beds in the lower part of the Jackson. In the Wilcox formation, the producing formation in the Falls City oil field, however, the displacement is about 275 ft.[1]. A rollover into the fault, or anticline on the downthrown block in the area where the fault bends from a northeastern to a more eastern direction, provided the structural trap for the oil.

The main Fashing fault is in the southeastern corner of Atascosa County, and extends northeastward into western Karnes County. Its southwest end has not been definitely located, but the fault probably extends into northern Live Oak County. It has been traced northeastward from a point about 5 miles west of Fashing, Atascosa County, and it disappears, on the surface, beneath the Catahoula tuff in the area where the Catahoula overlaps the Jackson in western Karnes County about 4 miles northeast of Fashing. Its surface trace is a broad arc, in the center of which the Fashing oil field (in the Carrizo-Wilcox) and the recently discovered Fashing-Edwards gas field (in the Edwards limestone) are located.

Movement on the Fashing fault has


98°30'
98°00'
29°00'
28°30'
OUTCROP STONES SWITCH SANDSTONE MEMBER
AREA OF MAXIMUM THICKNESS
2 — ISOPACH LINE SHOWING THICKNESS OF STONES SWITCH IN FEET
10 — STRUCTURE CONTOUR DRAWN ON BASE OF STONES SWITH DATUM IS SEA LEVEL
URANIAM PROSPECT IN STONES SWITCH
CORE HOLE IN WHICH STONES SWITCH IS RADIOACTIVE
U/D FAULT U UPTHROWN SIDE D DOWNTHROWN SIDE
FALLS CITY FAULT
HOBSON FAULT
TORDILLA HILL
FASHING FAULT
COY CITY FAULT
Coy City
Fashing
Karnes City
SAN ANTONIO R.

STRUCTURE and thickness is mapped of the Stones Switch sandstone, a member of the Whitsett formation. Fig. 5.



OUTCROP PATTERN and percentage of sand in the McElroy formation in Karnes County are shown. Fig. 6.

taken place periodically from at least early Cretaceous time and has continued into Catahoula-Miocene(?) time. The throw on the fault is about 100 ft. on the surface, in beds of the upper part of the Jackson; about 200 to 250 ft. in the Carrizo-Wilcox[6]; and an estimated 800 ft. in the Edwards[4].

In addition to the main up-to-the-coast fault, there is a compensating or secondary down-to-the-coast fault which lies ½ mile to about a mile northwest of the main fault where displacement has been greatest. A graben, therefore, has been formed just northwest of the main fault.

In addition to the Falls City and Fashing faults, two others in the Karnes County area are worthy of note: the up-to-the-coast Hobson fault, along which are the Hobson and Hysaw oil fields; and the down-to-the-coast Coy City fault, along which is the Coy City gas field.

Several minor faults with a north or northwest trend have also been mapped in the general area of the Fashing and Falls City faults. These are generally of short length, not generally longer than 2 or 3 miles. Their throw, cutting the Jackson rocks, is believed to be generally less than 100 ft.

Movement on the faults in the Karnes County area took place periodically from at least early Cretaceous to Miocene time, and in some instances affected the sedimentation that was taking place in the vicinity of the fault lines. In places the sediments are thicker on the downthrown blocks, and thinner on the upthrown blocks. In addition, sediments are generally coarser along the faults. The writer believes that topographic irregularities along the faults caused coarse sandstones to be deposited and, in places, erosion by channeling and filling of the channels by coarse sediments. In several places the line of faulting is marked by abundant blocks of finely laminated materials lying in jumbled disorder. In some places along or near the line of faulting concretionary deposits of calcium carbonate are found and tuffaceous sandstones are altered to quartzite, doubtlessly from waters circulating along the fault lines.

The Falls City fault cuts beds of the Manning clay member of the McElroy formation, the Wellborn sandstone, and the Caddell formation. The character and thickness of these beds are, as far as could be determined, similar along the fault as elsewhere, and the faulting seems to have had no influence on the sedimentation of the beds that it cuts. Thus, it is believed that the movement that affected the outcropping beds along this fault was subsequent to the deposition of these beds, and that the fault was stable at the time the beds were laid down.

The Fashing fault, however, cutting the outcrop of the upper part of the Jackson (Whitsett formation), had considerable influence on the sediments that were accumulating at that time. In the vicinity of the fault the beds show a different facies than elsewhere along the strike, and because of this, it was with difficulty that the beds, easily traceable outside of the fault zone, were traced through the area of greatest displacement of the rocks. At least one thick bed of sandstone was deposited in the area of the fault that does not appear elsewhere. This is a crossbedded coarse-

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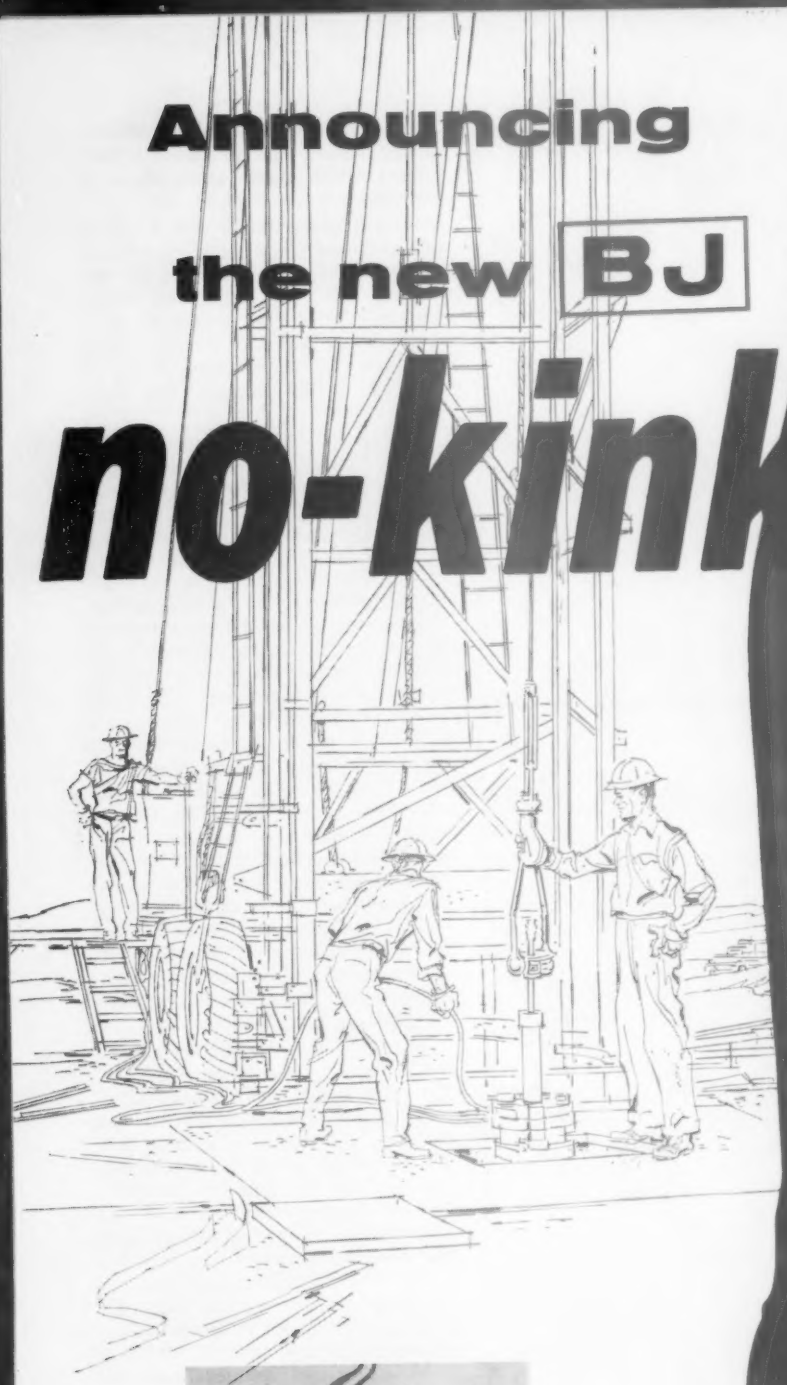
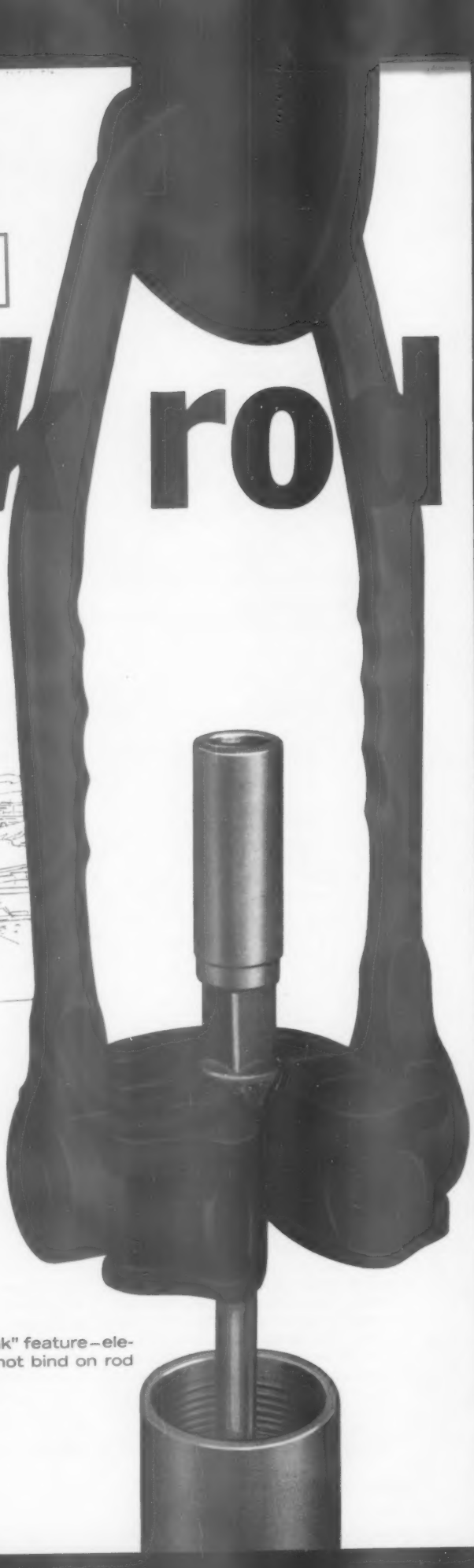


Exclusive "no-kink" feature – elevator body can not bind on rod under load.



...will not bend or kink sucker rods even under the heaviest loads!

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New from Byron Jackson—a rod elevator that will not bend or kink your sucker rods! The new body design of the BJ No-Kink Elevator employs stops which prevent rotation about the trunnion under load. The entire string is always freely supported in the body seat in line with the lifting load so that there is no possibility of kinking sucker rods even under the heaviest loads.

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Lasts longer—body has hardened rod seats at top and bottom, doubling service life.

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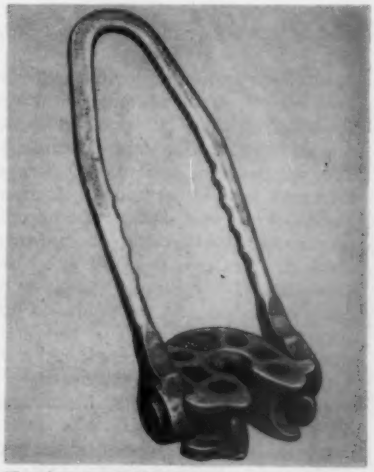

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grained brown-weathering channel-type sandstone, 40-ft. thick and containing many opalized wood fragments.

Regional structure and sedimentation. A subsurface investigation was made of two sequences of strata which show the regional relations of structure and sedimentation along or near the short line. The intervals studied in the subsurface were the Stones Switch sandstone member of the Whitsett formation, and the thicker McElroy formation, underlying the Stones Switch (Fig. 5). An isopach map of the Stones Switch was constructed using data from about 200 well logs and measurements of the thickness of the unit along the outcrop. On the same map contours of the structure of the base of this bed—the contact between the Whitsett and McElroy formation—were drawn.

The isopachs (dotted lines) show that the sandstone unit is 40 to 60 or more feet thick along its outcrop where the sandstone is believed in part to be deltaic in character. About 3 miles down the dip, the sandstone thins and forms a fairly regular tabular mass 40 to 50 ft. thick. This is believed to be near the center of the bay or lagoon in which the sand accumulated. Southeast of this zone for another 3 to 4 miles the sand was built up in a 70-ft. thick elongate mass which has the characteristics of an offshore bar. Southeast of this, the thickness of the Stones Switch diminishes, the beds are silt and clay, and the identity of the unit is lost. This deposition is believed to be on the marine or open-sea side of the offshore bar.

In constructing the isopach map, an oval-shaped area of much thinner sand, as thin as 30 ft., appeared southeast of the Coy City fault, just alongside of the area where the normal thickness is twice as much. A topographic high was doubtlessly present on an anticline on the downthrown block of the Coy City fault when the sediments of the Stones Switch were being deposited, and the sands did not accumulate on the crest of this anticline to the same thickness as elsewhere along this old offshore bar.

Conversely, a somewhat thicker area of sandstone deposition was found along downthrown blocks of the up-to-the-coast Fashing and Hobson faults. It is possible that this sand accumulated in the topographic depressions on downthrown blocks adjacent to the fault scarp which must have been active in Stones Switch time.

The study of the McElroy formation concerned the facies of the formation as a unit. The formation is made up of clay and interbedded sands, and the sand-clay ratio was calculated for a number of wells in central and southern Karnes County (Fig. 6).

Updip, the sand-clay ratio is between 20 and 25%. This gradually increases down the dip to the vicinity of Kenedy, in central Karnes County, to between 50 and 60%. This bank of high sand-clay ratio reaches a maximum along a northeast-southwest line, obviously, also, an offshore bar, but several miles to the southeast of the Stones Switch bar. The more clayey sediments up the dip were deposited in quiet waters in a lagoon or bay. The fossils found in this formation—oysters, thin-shelled pelecypods, and a few gastropods—also reflect this lagoonal environment.

Downdip from the offshore bar, the sediments of the McElroy are more clayey and within a few miles showed a sand-clay ratio of 30% or less. Obviously this was in the open marine environment. It is in this area that the chief fossils are foraminifers and other open-marine types.

It is believed that close study of other intervals, formations or members, would show the progressive movement of the strand line, and of its associated environments from one position to another, during the geologic history of the area. This would be done by closely correlating the units, constructing isopach and structural contour maps, and studying the facies of the unit. Thus the geologic history of the area, so necessary to know in finding oil, could be determined.

Conclusions

These studies of the Karnes County area have barely scratched the surface of the vast storehouse of knowledge that is hidden in the materials that may be studied: rocks and fossils, surface and subsurface geologic maps, well logs, and geophysical and geochemical data. By studying the relationships of lithologic character, thickness, structure, fossil and mineral content, and the physical properties of the rocks, and the chemistry of the fluids the rocks contain, as well as the areal distribution of the various stratigraphic units, many facts can be learned about depositional environment, and the geologic history of the area can be worked out.

Areas of abnormal thickening or thinning of the units from regional norms, areas of abnormal strike and dip and abrupt overlap of older beds by younger may point to structural anomalies. Areas of change of facies from one environment to another may point to areas where stratigraphic traps exist. These may very reasonably be explored for oil and gas accumulations, or for uranium occurrences.

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Sooner Manning trend will get new try

A new well for North Okarche field in southern Kingfisher County is Ohio Oil Co. 1 Zum Mallen Unit in C NW SE 18-15n-7w, an 8,300-ft. Manning test.

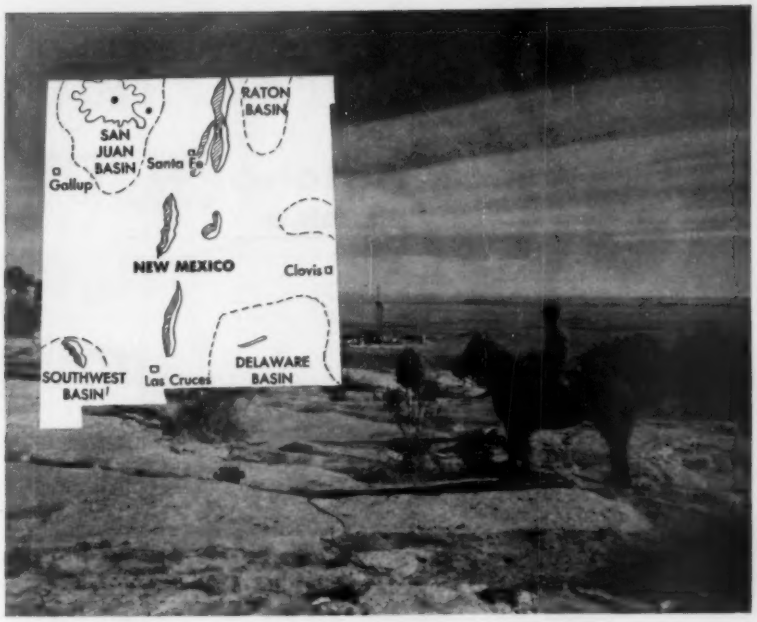
Location is north of Calvert Drilling Co.'s field discovery well at 1 Grummer in C NE 19-15n-7w. That well flowed 13,164 M.c.f.d. and 25 bbl. of condensate per million back in 1957. Later Ohio moved production in the pool to the east. Ohio's new well is 2 miles southwest of a discovery in 5-15n-7w, made by Apache Oil Co. That Manning well flowed 6 M.M.c.f.d.

Arkoma basin discovery looms in Latimer

Latimer County in southeastern Oklahoma may have Spiro sand production added to the 1 Orr discovery of Midwest Oil Co., and Frankfort Oil Co. The 1 Orr, SW 8-6n-22e, flowed 8 M.M.c.f.d. from Spiro sand at 11,514-80 ft. The well is already a discovery in upper zones.

Exploration Outlook

New Mexico drilling focuses on Dakota, Niobrara, and Abo



THE LAND OF ENCHANTMENT is busy with three major drilling campaigns—digging for Dakota Cretaceous oil inside the San Juan basin gas empire, adding the Niobrara to the long list of producing horizons in New Mexico, and swelling the Abo trend in Eddy County along the northern shelf of the Delaware basin.

The Dakota explosion

. . . tops New Mexico oil-hunting activities. This fast-moving play began more than 1 year ago, picked up 3 new oil fields and 39 gas finds last year, 5 gas strikes so far this year. Dakota rocks will continue to receive plenty of attention during the rest of 1960.

The rise of Dakota interest in the San Juan basin follows a pattern similar to all oil and gas provinces during the past decade—a trend toward deeper rocks. San Juan production before the advent of the Dakota was centered primarily in Upper Cretaceous Mesaverde and Mancos sands. Then came the big push to Gallup Upper Cretaceous in the Bisti and Carson trends 4 years ago. Now the Dakota section in the basin is primed for a thorough inquest. Production from the Dakota sands is zooming all over the confines of Blanco gas field. The only drawback in this new search for oil and gas could be lack of outlet. The Dakota has proved its power as a producer of oil and gas in the basin—outlet and demand will dictate how far the big exploratory play will go.

Newly-born Niobrara production

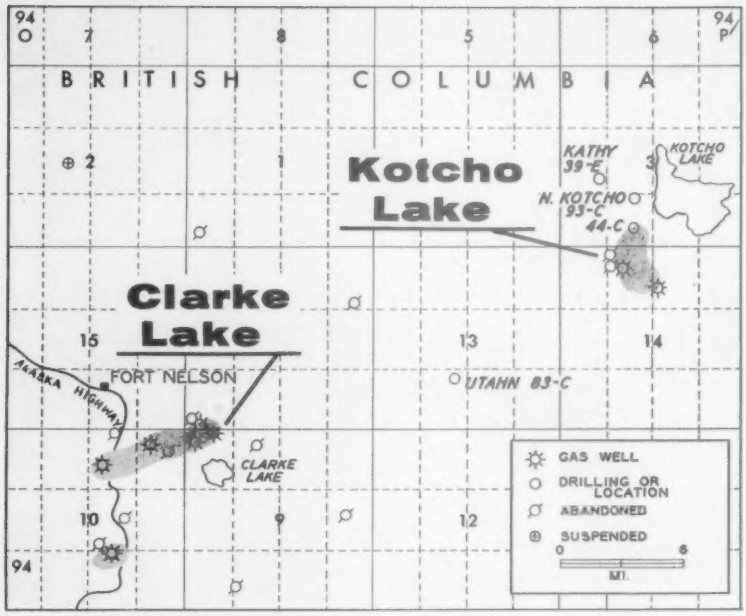
. . . gives the east side of San Juan basin its best hopes for the drilling future yet. First Niobrara oil production for New Mexico was established earlier this year at Intex Oil Co. 1 Alto in Rio Arriba County. This discovery was completed pumping and flowing 128 bbl. of 34.7°-gravity oil per day, setting off a flurry of locations in the area. East and southeast offsets are already going at the shallow discovery, while several wildcats are looking for Niobrara production around the field opener. A look at the driller's log on the 1 Alto discovery shows the Lewis Cretaceous from 0-368 ft., Mesaverde 368-824 ft., Mancos 842-1,765 ft., and the Niobrara pay from 1,765-1,958 ft. Several operators plan tests in this new play on the east side of the basin. Kern County Land Co. will drill on its Gallina prospect, 6 miles south of Intex's discovery. Kern County's tract is cut from south to north by the Mesaverde hogback where the Mesaverde shows a 28° dip toward the basin. The Nacimiento thrust fault is 3 miles east. There has been very little drilling on the eastern rim of San Juan basin. Results of current drilling to Niobrara (up the section from Dakota) will be watched closely by explorers in the southern Rockies.

The Abo reef trend

. . . in southeastern New Mexico continues to hold sway over Permian basin activities. This drilling program is about 2 years old and is one of the most interesting developments in this part of New Mexico in some time. Leasing is brisk up and down the reef. New activity on the trend, however, is not too conspicuous because the reef oil lies in an area of older shallow production and corresponding leases.

This march into Abo reef isn't spectacular as yet, but it is a steady encroachment on a new pay for the northern shelf area of the Delaware basin. It's too early to fully evaluate the full impact Abo production will have on New Mexico drilling, but it is a bright compansion to the busy plays in the northwestern part of the state.

John C. McCaslin.



NORTHEASTERN BRITISH COLUMBIA'S gas giant continues to grow with new Devonian production reported in the Kotcho Lake district.

British Columbia well indicates prolific Devonian gas flow

SLAVE POINT Devonian production is indicated at a well in northeastern British Columbia's Kotcho Lake district. The well is Pacific Petroleum, Ltd., B-44-C Kotcho Lake.

During tests the well flowed 7 M.M.c.f.d. on the first trial, 5,200 M.c.f.d. on the second. Location is on Quarter Unit B, Unit 44, Block C, NTS Index Map 94-P-3. It lies 4 miles north of Gulf States 3 Kotcho Lake Slave Point gas discovery, 22 miles south of a dry hole at Texaco-NFA 1 Thetsandoa, and 2½ miles south of Pacific D-93-C North Kotcho, a drilling well.

Southwest Texas study now available

A new publication, "Stratigraphy of the Pre-Simpson Paleozoic Subsurface Rocks of Texas and Southeast New Mexico," is now available from the Bureau of Economic Geology, University of Texas.

The work, by Vergil E. Barnes and others, has 837 pages, 38 text figs., 65 plates, 14 tables, and consists of two paper-covered volumes of text and a boxed set of charts. Price is $7.75.

This comprehensive publication contains results of a project initiated several years ago at the suggestion of Humble Oil & Refining Co. personnel and supported financially by that company and by Atlantic Refining Co., Gulf Oil Corp., Shell Oil Co., Sun Oil Co., and Texaco Inc. Many other companies and the USGS contributed to the work by supplying well sample material and maps and information through personal conference.

The study included all sedimentary rocks in Texas and southeast New Mexico, from the top of the Precambrian to the base of the Middle Ordovician Simpson group, and the main purpose of the project was to determine if established or other units of the pre-Simpson sequence could be recognized in the subsurface. Also, it was hoped that some shortcut method could be found by which these units could be identified.

The major part of the work as well as writing the publication and preparing the detailed illustrations was done by Dr. Barnes. Several independent papers on various phases of the pre-Simpson work are integrated in the volume; these papers are authored by P. E. Cloud, Jr., and A. R. Palmer, USGS; E. J. Tynan, University of Oklahoma; R. L. Folk and E. O. Jonas, The University of Texas. L. P. Dixon assisted Dr. Barnes in certain parts of the work.

The size of the printed material necessitated a division into two volumes—one of the main text papers and including 48 plates of photographs of cores and photomicrographs and 27-page index to the complete publication, and one of the 11 appendices which contain complete data assembled on the multitudinous wells pertinent to the project.

Supplement available to Texas structure maps

Confirming the pickup in activity over various segments of the industry during 1959, Rinehart has added a supplement to the latest annual "Structure Maps of New Texas Oil Fields" reference book.

An annual Rinehart Oil News Co. publication, the book contains 221 pages of structure maps (full-page size) as submitted during 1959 to the Texas Railroad Commission for rulings on new field discoveries.

The oil and gas-field exhibits supplement contains 151 pages of exhibits submitted during 1959 to the Texas Railroad Commission for injection projects and special field rulings.

Shallow hit in Texas

In Texas, Sunray Mid-Continent Oil Co. has apparently opened shallow production in Brown County with the completion of the wildcat, 1 Ruby Shelton, Section 36, HT&B RR Co. Survey.

The exploratory well, located 20 miles northwest of Brownwood, Tex., was finaled on the pump for a potential of 35 bbl. of 40°-gravity oil a day from perforations at 1,457-73 ft. in the Fry sand. Gas-oil ratio was 200:1 and the hole was drilled to 3,032 ft.

Sunray owns approximately 4,000 acres in area of the discovery well which is 4 miles east of proven production in the Brown County Regular field.

Palo Duro gets strike

THE all-but-oil-barren Palo Duro basin in the southern Texas Panhandle finally got a discovery. It is Texas Gulf Producing Co. 1 Bobbitt on the extreme north flank of the basin near the Amarillo Mountains.

Gage on tests was 2,500 M.c.f.d. through a separator on the casing with production in Permian Brown dolomite at 3,247 to 3,400 ft. This new pool is located in Section 95, Block 2, TTRR Survey, 5 miles northwest of Panhandle in Carson County.

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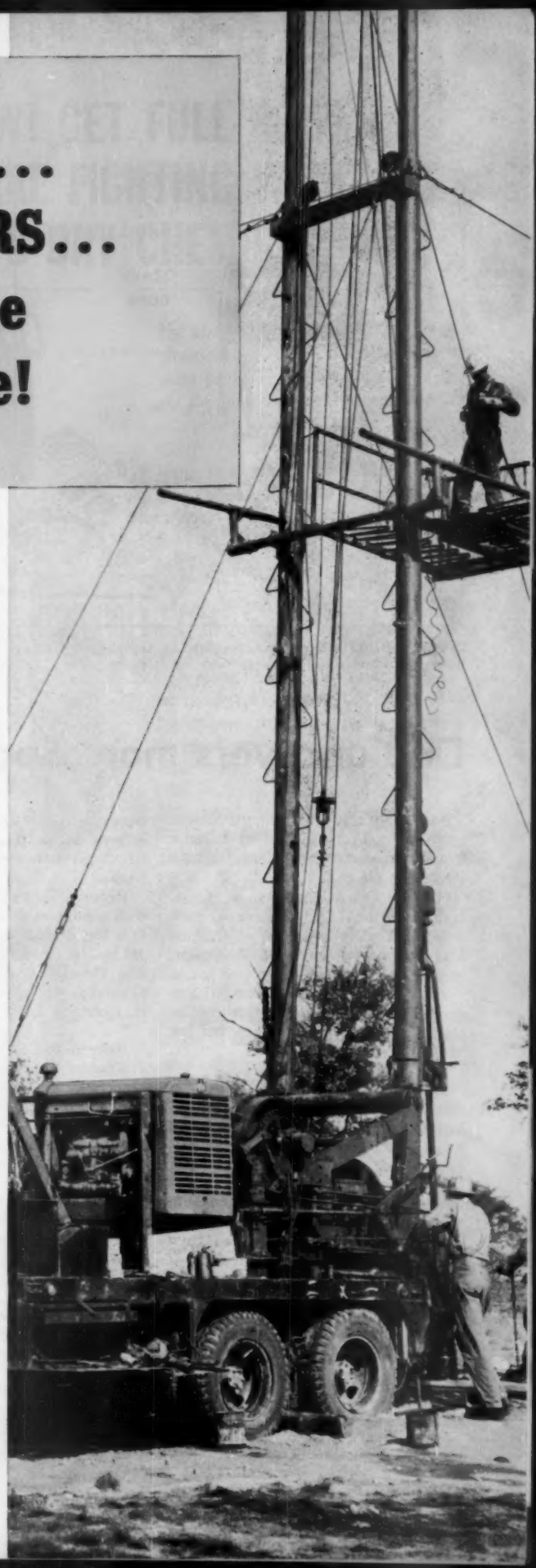

James Bomar, driller for Pool Well Service, Kilgore, Texas, is another enthusiastic International power booster. On the job shown here, Driller Bomar and his crew punched a 3,500-ft. well in five days—with steady, reliable power from their International U-450 engine, on his Wilson drilling rig. "It's a dependable engine," says Mr. Bomar. "Year after year the same smooth power that can instantly wind up to top speed and get the pipe out of the hole in a hurry. We haven't lost a minute from this International in four years!"

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CLOSELY GUARDED geologic secrets in southeastern Oklahoma's Latimer County are coming out into the open . . .

. . . as Sinclair dug to the Crystal Mountain sand of Ordovician age at the 1 Reneau, 11 miles southwest of Talihina.

Drill uncovers more Sooner secrets

SOME SECRETS of the highly faulted Potato Hills area of Latimer County, southeastern Oklahoma, have yielded to the drill.

Sinclair Oil & Gas Co., of Tulsa, completed the 1 A. H. Reneau, rank wildcat 11 miles southwest of Talihina and 32 miles southeast of McAlester, as a shut-in gas discovery.

For its efforts and investment, Sinclair also obtained much information about a little-known province, but left many questions unanswered.

Location. The wildcat drilled in NW SE NW 32-3n-20e, on a geological surface structural high found by surface mapping. Located about 12 miles south of the Choctaw fault, a well-known geological feature, the Potato Hills are part of the Ouachita Mountains.

Presence of the feature has been known for more than 50 years, and it has been listed on Oklahoma Geological Survey maps for 30 years. The general area had been surveyed as early as 1923 by the Oklahoma Geological Survey. Numerous asphalt deposits have been known to exist in the vicinity of the Ouachitas for decades.

Few wells. Despite the presence of the geological feature, no deep wells were previously drilled due to lack of information on reservoir rocks and the structural complexities of the Ouachitas.

Records indicate a small gas show with a rainbow of oil was encountered in a test drilled some 40 years ago in 30-3n-21e, in Latimer County. Mineral Development Association drilled to total depth of 2,600 ft., setting 6⅝-in. casing at 2,340 ft.

Reneau. Main objective of Sinclair's 1 Reneau was the Crystal Mountain sand of Ordovician age found at 6,286 ft. But the Crystal Mountain was found barren and tools were taken to a total depth of 7,097 ft. in the Collier shale, topped at 7,011 ft.

Sinclair backed up the hole and completed the well in the Big Fork chert through perforations at 2,340 to 2,410 ft. for a calculated open-flow potential of 1,850 M.c.f.d.

The find. What did Sinclair find in making hole? Tools penetrated a series of thrust slices which resulted in five successive occurrences of Big Fort chert and Womble shale. The first occurrence of Big Fort chert came at 645 ft. The same formation was encountered for the fifth time at 5,184 ft.

Drilling. Sinclair ran nine drill-stem tests, six of which found gas shows. One test failed and two others were without results.

Sinclair staked location April 29, and spudded with cable tools May 9, 1959. Crew ran 103 ft. of 20-in. conductor pipe at 104 ft.

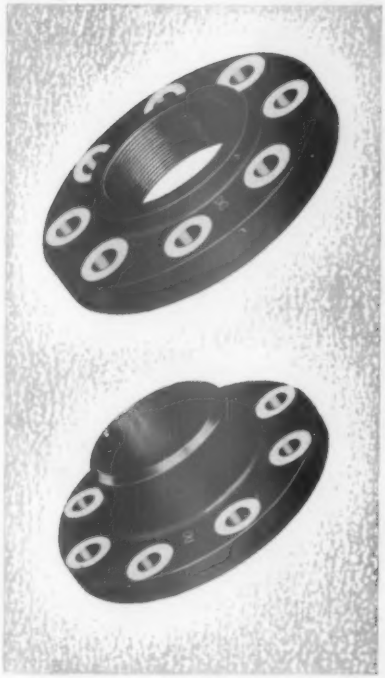
The Arkansas novaculite, used in manufacturing whetstones, was encountered at 225 ft., measured from ground level. Other shallow markers included the Missouri Mountain shale at 545 ft., Polk Creek shale at 593 ft., and Big Fork chert at 645 ft.

Fleet Drilling Co., of Ada, moved in its large rotary rig capable of drilling 13,000 ft. and began making hole at 942 ft. Air was used until excessive water was found at 1,394 to 1,418 ft. Beginning at 1,530 ft., mud replaced air to handle water intrusion and to offset flaking in the hole.

The Womble shale was first encountered at 1,602 ft., and 9⅝-in. casing was set at 1,843 ft. with 150 sacks.

Drilling with air was resumed at 1,843 ft., but water was again encountered and contractor returned to mud beginning at 1,991 ft.

A second section of the Big Fork chert was found at 2,174 ft., indicating a thrust fault with displacement



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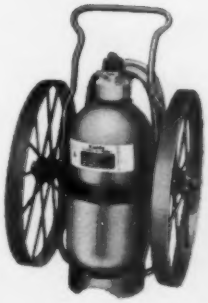

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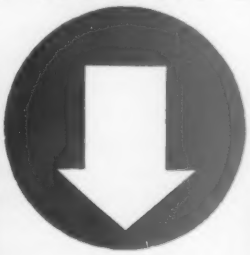

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in excess of 900 ft. A small gas kick was encountered at 2,270 ft., and the first of the nine drill-stem tests was run at 2,264 to 2,315 ft. in the Big Fork chert.

Additional markers included: Womble shale, 2,526 ft.; Big Fork chert, 2,572 ft.; Womble shale, 3,372 ft.; Big Fork chert, 4,280 ft.; Womble shale, 4,972 ft.; Big Fork chert, 5,184 ft.; Womble shale, 5,796 ft.; Crystal Mountain sand, 6,286 ft., and Collier shale, 7,011 ft.

The nine drill-stem tests, interval, and results were:

No. 1—Big Fork chert, 2,264-2,315 ft., 150 M.c.f.d. of gas.

No. 2—Big Fork chert, 2,318-62 ft., 1,100 M.c.f.d. of gas.

No. 3—Big Fork chert, 2,372-2,421 ft., 1,343 M.c.f.d. of gas.

No. 4—Big Fork chert, 2,423-90 ft., 2,220 M.c.f.d. of gas.

No. 5—Big Fork chert, 2,494-2,564 ft., 88 M.c.f.d. of gas.

No. 6—Big Fork chert, 2,590-2,663 ft., volume too small to measure.

No. 7—Womble shale sand sections, 6,062-95 ft., no results.

No. 8—Womble shale sand sections, 6,296-6,358 ft., no results.

No. 9—Crystal Mountain sand, 6,296-6,358 ft., failed.

Final bottomhole shut-in pressure on the drillstem tests ranged as high as 1,130 lb.

Sinclair cored in the Crystal Mountain sand from 6,360 to 6,376 ft., with no shows in recovery.

Completion. After taking tools to total depth of 7,097 ft. in the Collier shale, Sinclair backed up and cemented 4½-in. casing at 2,652 ft. with 300 sacks. The Big Fork chert was exposed through perforations at 2,340 to 2,480 ft. with 560 shots.

On test, the well flowed to pits for 12 hours, yielding 184 bbl. of brackish salty water. Gas volume hit 638 M.c.f.d. through a 21/64-in. choke after 12 hours.

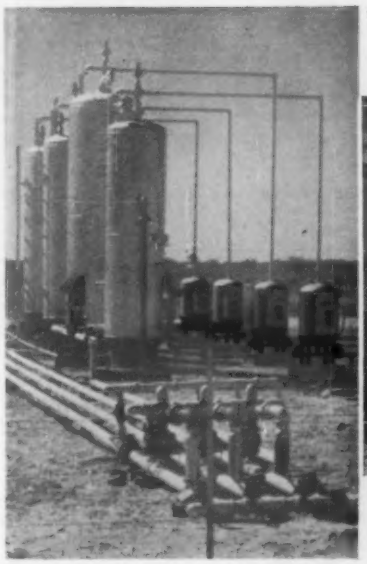
Perforations were squeezed and cement was drilled out to 2,410 ft. The zone at 2,340-2,410 ft. was tested with tubing set at 2,309 ft. The well kicked off and flowed load to pits for 5 hours, then flowed 1,202,000 cu. ft. of gas with no water on ¾-in. choke.

Urban Los Angeles draws wildcatters

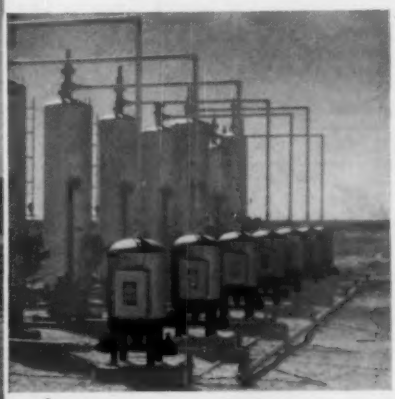
California's wildcatting was spotlighted by a series of tests planned and under way in metropolitan Los Angeles. A rundown on the activity showed:

Beverly Hills. Allen Guiberson, operator, was grading location for his

METROL "CV" VOL-U-METERS



◀ METROL Model 10-CV-01 Vol-U-Meters metering and comingling oil from four separate royalty interests into a common tank battery.



▲ METROL 10-CV-01 Vol-U-Meters metering and comingling oil from seven dual completed wells into a common tank battery.

METROL® "CV" VOL-U-METERS® are designed for accurate metering of crude oil and water by cyclic accumulation, isolation and discharge of equal volumes.

METROL "CV" VOL-U-METERS are available in standard sizes, ¼, ½, 1, 2, 5, 10, 20 and 30 barrels per dump. Standard working pressures are 125, 300, 600 and 1200 psi. Capacities are shown in table below.

Metering accuracy of METROL "CV" VOL-U-METERS depends on proper liquid level control and proper valving, both of which are obtained and maintained. Accuracies of 99.99% are common. This accuracy is attributed to the vessel's patented snap-acting pilot mechanism*. Pilots used on VOL-U-METERS are reliably accurate and react at exact preset upper and lower levels. VOL-U-METERS are approved by most regulatory bodies for measuring oil for royalty and tax payments, testing wells, and comingling oil.

Average repair parts cost for METROL "CV" VOL-U-METERS is less than $5.00 per unit per year! Ruggedness and simplicity of these units, added to their high accuracy and dependability, make them the best meter for metering crude oil upstream of lease storage tanks.

Accurate metered volumes, low maintenance cost, trouble-free operation, efficient and accurate handling of production, increased field safety, and additional lease automation are among advantages provided by METROL "CV" VOL-U-METERS.

UNIT MODEL NO.	2½ CV	5 CV	10 CV	20 CV	50 CV	100 CV	200 CV	300 CV
Volume per dump, Bbl.	¼	½	1.0	2.0	5.0	10.0	20.00	30.0
Metering Capacity BPD								
Rated	300	500	720	1,440	2,000	4,000	8,000	15,000
Maximum	500	650	1,200	1,800	3,000	5,000	12,000	20,000
Avg. Expected Metering Accuracy, Percent	99.80	99.90	99.95	99.97	99.98	99.99	99.99	99.99

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Pennsylvania shallow well completion data, 4th Quarter, 1959

County—	Completions						Footage					
	Oil	Gas	Water input	Dry	Storage wells	Drilled deeper	Oil	Gas	Water input	Dry	Storage wells	Drilled deeper
Allegheny	....	....	....	....	1	....	.....	.....	.....	.....	2,328	.....
Armstrong	....	21	....	1	....	‡4	.....	65,789	.....	3,410	.....	†2,905 *808
Beaver	....	....	....	1	....	....	.....	.....	.....	1,640	.....	.....
Butler	....	1	....	....	....	*1	.....	1,591	.....	.....	.....	153
Clarion	....	11	....	....	....	....	.....	28,033	.....	.....	.....	.....
Elk	....	2	....	1	....	....	.....	4,167	.....	2,268	.....	.....
Fayette	....	2	....	....	....	....	.....	5,833	.....	.....	.....	.....
Forest	....	3	....	2	....	....	.....	5,492	.....	4,036	.....	.....
Greene	....	....	....	....	2	....	.....	.....	.....	.....	140	.....
Indiana	....	3	....	1	....	†1	.....	10,967	.....	3,943	.....	1,443
Jefferson	....	6	....	5	....	†1	.....	18,669	.....	14,926	.....	924
McKean	45	....	38	2	....	§1	79,426	.....	69,198	4,100	.....	400
Venango	3	....	....	....	....	....	2,635	.....	.....	.....	.....	.....
Warren	6	....	....	....	....	....	5,365	.....	.....	.....	.....	.....
Washington	....	1	....	2	1	....	.....	2,303	.....	5,057	2,517	.....
Westmoreland	....	5	....	4	....	†2	.....	15,826	.....	15,678	.....	1,600
Total	**54**	**55**	**38**	**19**	**4**	**10**	**87,426**	**158,670**	**69,198**	**55,058**	**4,985**	**8,233**

*Dry. †Gas. ‡2 gas, 2 dry. §Oil.

second test on the east extension of Universal Consolidated Oil Co.'s highly successful operations on the 20th Century Fox film property in the old Beverly Hills field. Guiberson joined the producing list in the field in January with a 350-bbl.-daily well perforated at 5,247-5,548 ft. Universal Consolidated has wells in at least two zones in the old field.

Cheviot Hills. Immediately adjoining the Universal-Guiberson activity, Signal Oil & Gas Co. was continuing its development of two golf course leases and some community leases. Their fourth well on the Hillcrest Country Club course and their seventh on the neighboring Rancho golf course were being completed.

Culver City. Early reports were discouraging on Continental Oil Co.'s second test on its M-G-M studio lease. This second directionally drilled wildcat was redrilling at 8,310 ft. after going to 9,594 ft. on the first try. The first Continental wildcat in the area touched off a flurry of leasing activity late last year when it came in making 720 bbl. daily from a zone between 8,660-8,807 ft.

Century Park. Texaco Inc., was in the urban drilling parade with a wildcat located about 1 mile west of the

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old Athens-Rosecrans area in south Los Angeles. The Texaco test was drilling below 8,035 ft. in a general area where production was first found in 1924 and 1925 at around 5,000 ft.

Salt Lake. Like the Universal-Guiberson activity in the old Beverly Hills field, the interest here is in possible deeper production in an area which dates its first wells back to pre-World War I days.

Union Oil Co. of California was redrilling a 9,512-ft. wildcat on the northeast flank of the old field while Buttram Petroleum Corp. had a location staked nearby for an 8,500-ft. wildcat.

Brentwood. Mobil Oil Co. was grading and landscaping a location on the Brentwood Country Club near the Los Angeles-Santa Monica border. This test will rank as the most northwesterly of the current rash of wildcats in residential Los Angeles. It's about 3 miles from the productive 20th Century Fox properties.

East Los Angeles. General Exploration Co. was drilling below 8,028 ft. on a wildcat located about ½ mile southeast of production in the East Los Angeles field. About 2 miles away, and ½ mile north of the neighboring small Bandini field, Nordon Corp., Ltd., was preparing a drill site for a 6,500-ft. test.

Drilling slated for Arctic well

ANOTHER WELL was staked in the Rond Lake area of the Northwest Territories in Canada. Western Decalta Petroleum, Ltd., et al. 2 Rond Lake, 40 miles north of the Arctic Circle and 1 mile northwest of the 1 Rond Lake (currently suspended), will begin soon.

The Rond Lake program is being carried out in and around one of the largest natural oil seeps in the Far North. Devonian rocks will be the target for the wildcatters here—the zone productive at Norman Wells.

Old field slated for big well program

Union Oil Co. of California announced a 22-well program for the old Richfield field in Orange County. Union said the drilling project was planned because residential growth in the area was rapidly crowding out drill sites. Union drilled its first well on its Stearns lease in the field in June 1900. Since that time, the operator has completed 165 wells and produced 56,800,000 bbl. from the lease. One well completed in 1909 has produced more than 2,400,000 bbl. of oil and was still pumping 90 bbl. daily.

Deeper test planned for Rincon Island

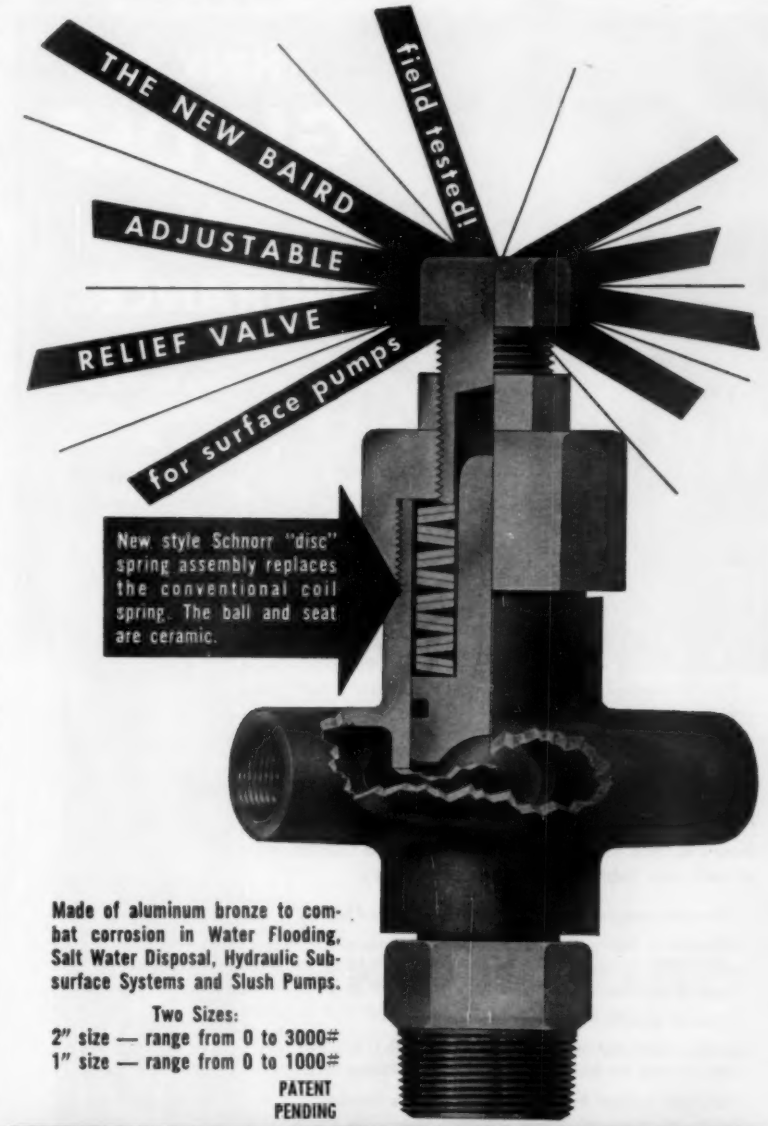
Richfield Oil Corp. announced plans to drill a 7,000 ft. test from its artificial island on the 1,170-acre offshore lease it has off Rincon, Ventura County, California. Richfield has been drilling development wells on the lease which total depth in the 3,500 to 4,000-ft. range generally.

Alberta well to be spudded soon

Under a farmout agreement with New York Oils, a wildcat well in the Sene Creek area of northern Alberta is to be spudded shortly by the team of Canadian Oil Companies, Ltd., Home Oil, and Alminex, Ltd.

The wildcat is located 50 miles southeast of Fort Vermilion. The well, White Rose et al. Senex Ck., 6-33, is to be operated by Canadian Oil and is the company's farthest-north venture to date. It will be bottomed at 4,200 ft.

Drilling costs will be borne 50% by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Canadian Oil and 25% each by Home and Alminex. New York Oils and its associates, Crusade, Dynamic, and Glendale, retain an unstated interest in the lands involved.

The contractor, Seaman Engineering & Drilling Co., Ltd., is expected to have a rig on the site immediately.

Prolific confirmation well in Kansas flows

A 100-bbl. per hour confirmation discovery was reported last week in Barton County, southern Kansas. It is Thunderbird Drilling Co. 2 Lucas in SW NE SW 4-19s-12w. Gage was 100 bbl. per hour during test of the Lansing Pennsylvanian at 3,162-64 and 3,167-74 ft.

The field, Cheyenne, was opened at 1 Lucas in NE SW NW 4-19s-12w, pumping 182 bbl. per day from the Lansing at 3,265-72 ft.

Michigan basin continues to record successes

The thirteenth and fourteenth successful completion against one failure were made in the McBain pool, Missaukee County, the most active area in the Michigan basin. The offsets were drilled by Robert Peckham and Leonard Oil, Inc., on the east side of the field. Production is from the Dundee at 4,000 ft.

Robert Peckham 1 Robinson, NE SW NW 20-21n-7w, flowed 150 bbl. oil in 7 hours natural at 4,034 ft.

New Las Vegas test scheduled

Trans-World Oil Co., Las Vegas, announced plans to drill a 3,000-ft. wildcat about 16 miles southeast of Las Vegas. The drill site will be in NW NE 30-22s-63e.

In northern Nevada, Churchill Drilling Corp. was fishing in a 5,300-ft. wildcat 3 miles south of Fallon in Churchill County.

Offset drilled to strike in Ohio's Morrow

In Ohio, considerable attention is being focussed on the first offset to Monk Oil & Gas Co.'s new field discovery in Bennington Township, Morrow County (OGJ, Jan. 11, 1960).

Drilling has ceased at 3,739 ft. and logs have indicated shows in two zones of the Cambro-Ordovician that will be acidized. The first zone at 3,601-07 ft. has a porosity of 5% with oil saturation of 65%. The other zone at 3,614-20 ft. has a porosity of 6% with oil saturation of 70%. Free oil is negligible.

This location, 1 P. & B. Boyd, Lot 16 1 Quarter, Porter Township, Delaware County, is about 1,800 ft. south of the discovery well and is being drilled by the same operator.

Gas hunting continues brisk in Anadarko

Gas exploration and development continues to lead activity in the Oklahoma portion of the Anadarko basin. Focal points now are Northeast Seiling in Major County and West Chester pool in Woodward County.

J. M. Huber Corp. extended Mississippian Chester pay in Northeast Seiling field at 1 Rohla in C SE NW 24-20n-16w. A drill-stem test at 8,261-8,330 ft. got up to 1,140 M.c.f.d.

New West Chester field in Woodward County has been confirmed by Ashland Oil & Refining Co. at 1 Fox Unit in C SW NE 4-20n-17w. The well flowed 40,190 M.c.f.d. from Chester perforations at 7,990-8,010 ft. The third well has started in this field. It is 1-A Wyckoff, C SE NW 3-20n-17w.

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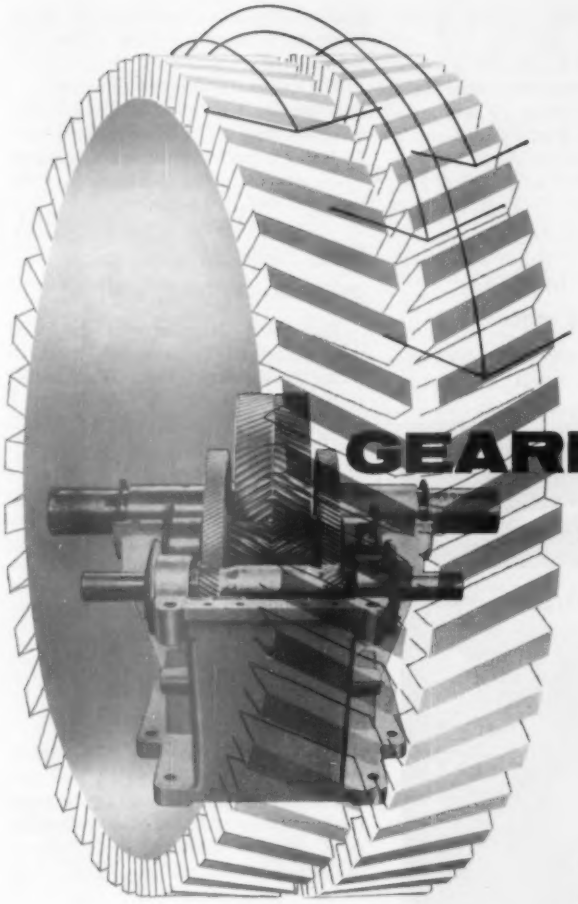

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Hunton group oil moves South Oklahoma

Southern Oklahoma's Joiner City area in Carter County is gaining good wells in Hunton.

Frankfort Oil Co. 1 Brown, SE SW SW 32-4s-3w, flowed 251 bbl. of oil in 13 hours on 31/64-in. choke, natural, from open hole in the Bois d'Arc lime at 7,819-91 ft. A later test made 210 bbl. per day on 22/64-in. choke.

The 3 Hester, C SW SE 12-5s-3w, swabbed 87 bbl. per day from upper Hunton at 9,512-42 ft. and 9,560-80 ft.; from Chimney Hill at 9,944-10,007 ft. swab got 78 bbl. per day.

The 4 Hester in C SE SW 12, another Bois d'Arc Siluro-Devonian well, flowed 66 bbl. of oil in 16 hours on 20/64-in. choke. Perforations were at 9,654-98 and 9,706-16 ft. The 5 Hester, C SW SW 12, swabbed 115 bbl. of oil in 6 hours from Bois d'Arc lime perforations at 9,708-70 ft.

Oklahoma's Flint Creek area extended again

South Flint Creek field, McClain County, South Central Oklahoma, gained a dual completion at Fred Morgan 1 Moore in C NW SW 5-5n-2w.

The well flowed 16 bbl. of oil hourly from Hart sand at 7,452-72 ft.; from Hunton at 7,628-48 ft. it flowed 20 bbl. per hour. Both flows were on ¼-in. chokes. The 2 Moore is drilling in C SW SW 5-5n-2w.

Panhandle Mississippian area bags third well

The third Mississippian gas well was added to Ellis Ranch field in Ochiltree County, Texas Panhandle. It is Shamrock Oil & Gas Corp. 1 Carl Ellis et al. in Section 918, Block 43, H&TC Survey.

The well flowed 1,370 M.c.f.d. from perforations at 8,713-21 ft. Nearest similar production is at 2 Kelln, the discovery of Mississippian production on the southeast side of Barlow field. It lies 3½ miles northwest of 1 Tregellas, Mississippian discovery for Ellis Ranch field itself.

Strawn oil opened in Atrice, Texas, area

Tom Green County in southern West Texas has new Strawn Pennsylvanian sand production at Fortune Drilling Corp. 1 Mary Hobbs Griffith et al., 8 miles southeast of Christoval in Section 44, Block 25, H&TC Survey.

The well was completed flowing 126.5 bbl. of 33°-gravity oil per day on 22/64-in. choke from perforations at 5,032-74 ft. The well is in Atrice field which has Harkey sand production at 4,703-13 ft. Nearest Strawn production is 1½ miles southeast at Atrice in the 5,150-ft. zone.

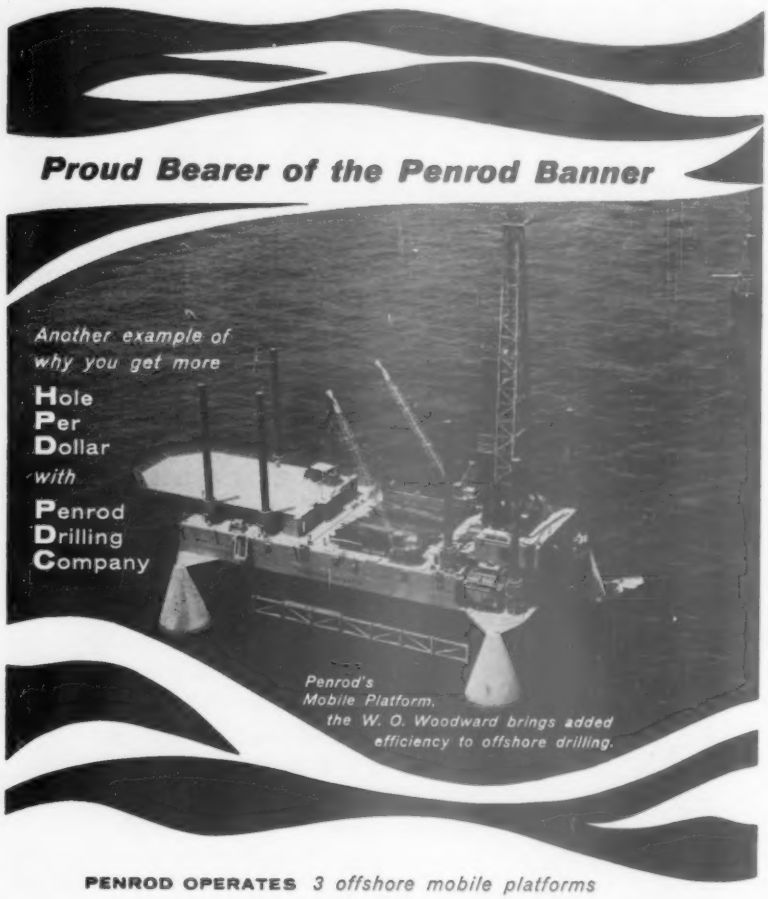
Flowing Mississippian oil in Texas' Young

Young County in West Central Texas has a Mississippian oil discovery at Bobby M. Burns 1 Weitinger.

The well flowed 140 bbl. of oil daily on 8/64-in. choke from Mississippian open-hole section at 5,221-26 ft. Nearest Mississippian production is 4½ miles northwest in Archer County Regular field. Location is in W. C. Adams Survey A-1364. Suggested name for the new area is Weitinger Mississippian.

Big Ellenburger well finaled in North Texas

A significant Ellenburger Cambro-Ordovician discovery for northwestern Archer County, Texas, is Jack Grace Production Co. 1-A O'Donohoe in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Block 95, American Tribune New Colony Lands Subdivision, 6 miles southeast of Mankins. The well potentialed flowing 864 bbl. of 42°-gravity oil daily on ½-in. choke from perforations at 4,965-87 ft. The well opens Kickapoo Ellenburger field.

Discovery wells

CALIFORNIA

Kern County:

Shell Oil Co. 23X-14 KCL A, SW NW 14-30s-25e, 2,900 M.c.f.d., 13/64-in. choke, perfs. 3,089-3,104 ft., 3,822-27 ft., 3,994-98 ft. and 4,034-38 ft. TD 6,300 ft. (Gas discovery in Canal oil field).

Verde Enterprises, operator for Ancora Corp. 77-34 Union-Signal, SE SE 34-31s-29e, 99 BOPD, 33°-gravity, 1% cut, 15/64-in. choke, perfs. 9,086-9,194 ft. TD 9,543 ft. (New pool discovery 1 mile south of Mountain View field).

WESTERN CANADA

Alberta:

Home-FPC 4-31 Morse River, LSD 4, 31-65-9w5. Beaverhill Lake oil discovery. TD 8,361 ft. Pan American-Hudson's Bay-Fina 7-33 A-1 Kaybob, LSD 7, 33-60-19w5. Cadomin gas discovery. TD 10,350 ft.

British Columbia:

Phillips SR West Canadian D-64-H Peejay, D-74-H-94-A-15. Triassic oil discovery. TD 3,890 ft.

COLORADO

Moffatt County, West Moffatt area:

Texaco Inc. 18 Government-Knowlton, NW NW 10-4n-91w, IPF 1,098 BOPD, 32/64-in. choke, 39.9°, Weber slotted liner 5,880-88 ft. TD 5,975 ft. Weber discovery, new field.

KANSAS

Barber County:

Walters Drilling Co. 1 Inslee, C SE NE 19-31s-10w. IP 60 BOPD, 35.5°, Miss. 4,530-32 ft. TD 4,602 ft. Opens revived McReynolds field.

SOUTH LOUISIANA

Acadia Parish:

Cabot Carbon Co. 1 Leonard A. Habetz, 18-9s-1e, 1 mile southeast of Ellis field. IP 2,500 M.c.f.d., 40 to 50 BC per M.M.c.f., 10/64-in., TP 4,550 psi., perf. 11,562-65 ft. TD 11,652 ft. New-field discovery.

The California Co.-Monterey Oil Co.-Richardson & Bass 1 Dr. Charles H. Wright 2 et al. Unit 2, 40-11s-2w. IP 4,110 M.c.f.d., 30 BCPD, 11/64-in., 53.4°, TP 6,400 psi., perf. 15,085-92 ft. and 15,107-16 ft. TD 15,278 ft. Extension and new pay in South Mermentau field.

Iberville Parish:

J. P. Owen et al. 1 A. R. Albritton et al., 113-7s-9e, 3 miles west of Rosedale field. IP 45 BOPD, 10/64-in., 38.5°, GOR 7,560 cu. ft. per bbl., TP 950 psi., perf. 9,995-10,064 ft. TD 10,073 ft. New-field discovery.

Terrebonne Parish:

Anderson-Prichard Oil Corp. 1-B South Coast Corp., 18-17s-18e. IP 2,300 M.c.f.d., trace condensate, 10/64-in., TP 3,975 psi., perf. 11,598-11,628 ft. TD 12,935 ft. Extension and new-reservoir discovery in Southeast Houma area.

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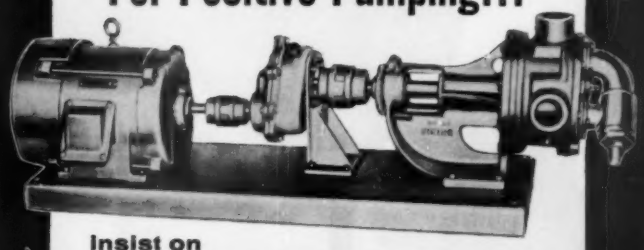

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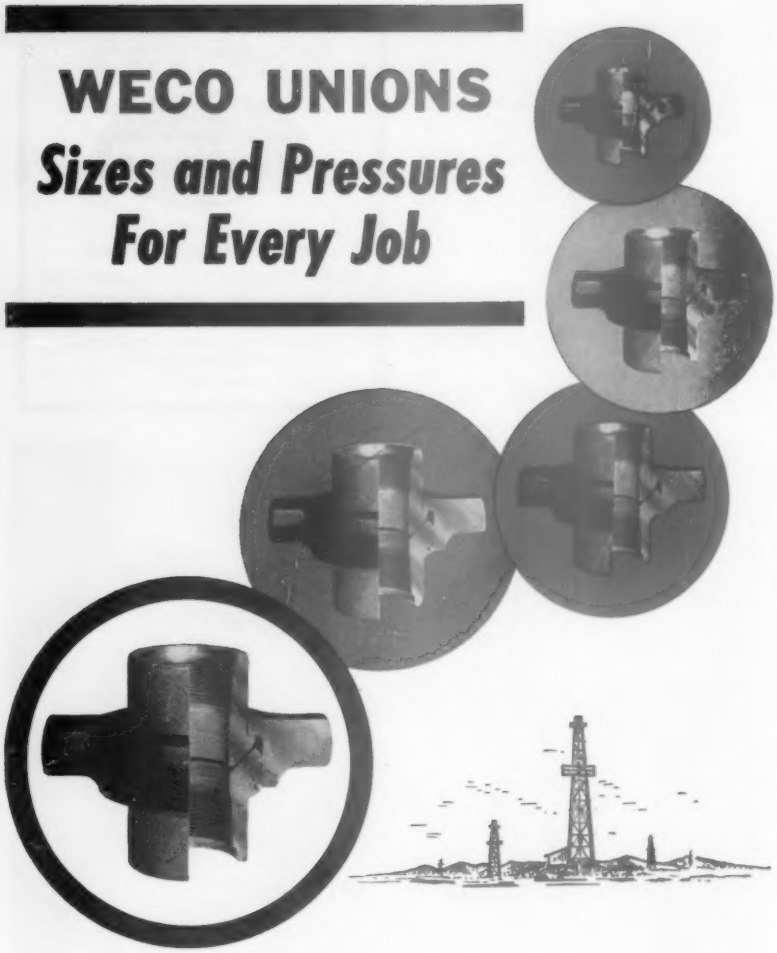

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MICHIGAN

Jackson County:
Perry Fulk 1 Zaremba Unit, SE SE NE 28-4s-3w, 2 miles southwest of Scipio. IPP 40 BOPD, bottom-hole pressure 1,340 psi. Elev. 1,091 ft. Trenton 3,722 ft., Black River 4,072 ft., pay 4,336-56 ft. New pay extension. TD 4,356 ft.

St. Clair County:
Sunray Mid-Continent Oil Co. 1 Bollaert, C NW SW 33-6n-13e, 18 miles northwest of Peters field. IP 172 BOPD, 12/64-in. choke, 1 M.M.c.f.d., TP 525 psi., Elev. 811 ft., Niagaran 3,596 ft., pay 3,585-3,660 ft., 3,765-75 ft., 3,800-25 ft. TD 4,061 ft. New oil field.

NEBRASKA

Banner County:
Pure Oil Co. 1 Brauer-B, C SW NE 23-18n-57w. IPP 105 BOPD, "J" sand discovery, new field. TD 6,790 ft.

NEW MEXICO

Rio Arriba County:
Val Reese & Associates 1-11 Van Denburgh, SW SW 11-23n-7w. IP swabbed 156 BOPD, Gallup 5,412-5,728 ft. TD 5,775 ft. Gallup discovery, new pool.

OKLAHOMA

Beaver County:
Mayflo Oil Co. and Carter Oil Co. 1-9 Jenkins, 9-1n-24eCM. IPF 22,500 M.c.f.d., 862 BOPD, Morrow 8,032-47, 8,562-68 ft. TD 8,780 ft. New field.
Oklahoma Natural Gas Co. 1 Custer, C SW NE 31-2n-23eCM. IPF 5,400 M.c.f.d., 27 BOPD, Morrow 7,402-21 ft. TD 8,115 ft. New field.
Cities Service Oil Co. 1 Benjegerdes, C 2-3n-23eCM. IPF 333 BOPD, 40°, Marmaton 5,914-24 ft. TD 7,285 ft. New field.
Stekoll Petroleum Corp. 1 Amy Patten, C NW SE 34-5n-28eCM. IPF 2,400 M.c.f.d., Mississippian 6,641-78 ft. TD 6,917 ft. New field.

Caddo County:
J. M. Huber Corp. 1 Boos, C NW SW 35-5-11w. IPF 3,320 M.c.f.d., 10,800 M.c.f.d., Springer sand 7,519-7,603 ft.; 7,928-8,056 ft. TD 8,306 ft. New field.

McClain County:
Brooks Hall 1 Morris Unit, SE NW 3-5n-2w. IP 200 BOPD, Hunton 7,420-50, 7,395-7,410 ft. TD 8,455 ft. Offset.

WEST CENTRAL TEXAS

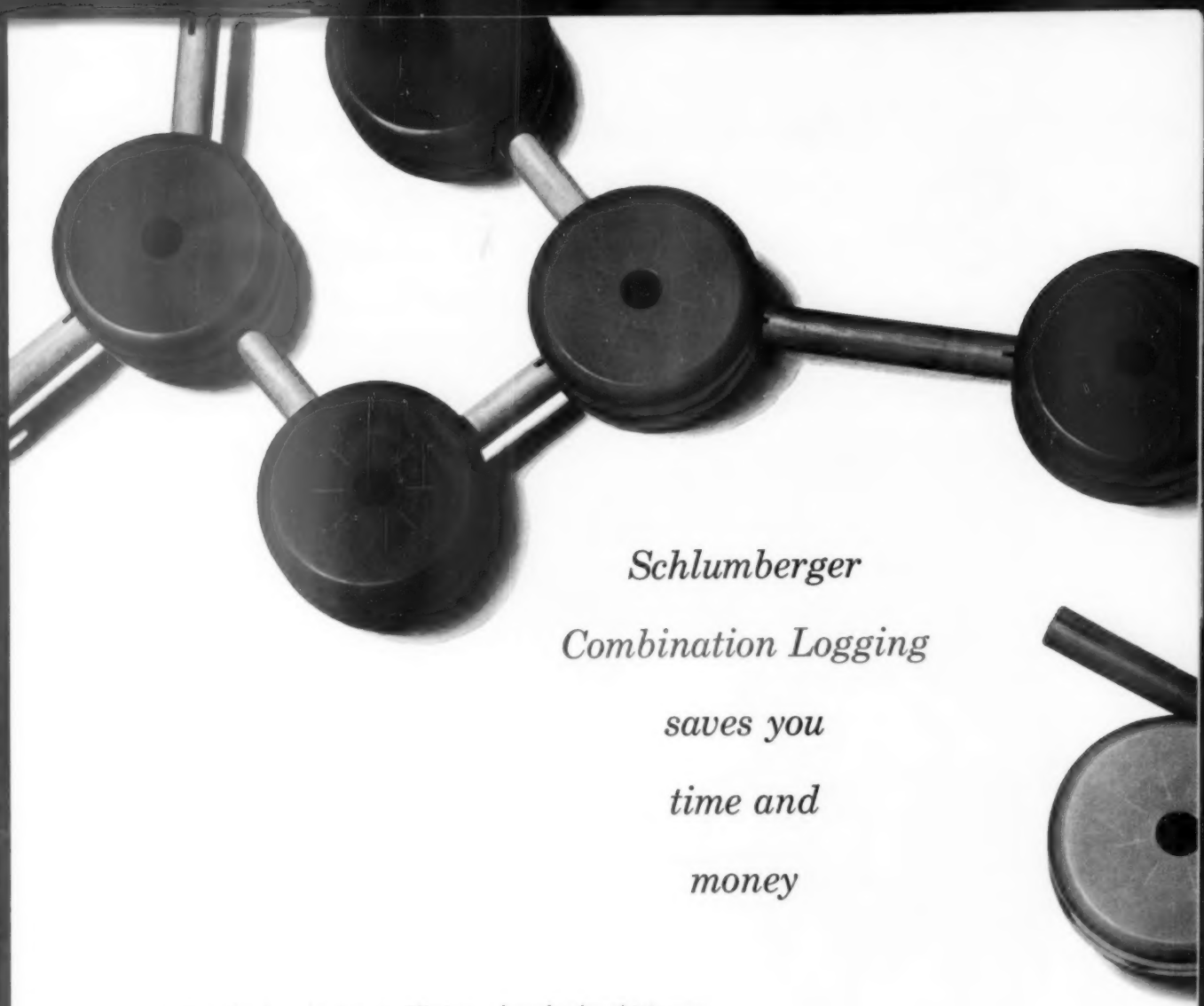
Palo Pinto County:
Texoma Petroleum Co. 3 Hinkson, 5 miles northeast of Strawn in Sec. 83, Blk. 3, T&P Sur. IPF 58.3 BOPD, 87% water, ½-in. choke, 41°, GOR 2160:1, lime 3,240-64 ft. TD 3,655 ft. New oil discovery.

UTAH

Duchesne County:
Continental Oil Co. 28-1 Smith, C NE NE 28-4s-4w. IPP 19 BOPD, 4 BWPD, 21.2°, Green River discovery, new field. TD 3,031 ft.

San Juan County:
Pure Oil Co. 1 Northwest Lisbon, NE NW 10-30s-24e. IPF 587 BOPD, 14/64-in. choke, 44°, McCracken Devonian 8,251-8,348 ft. TD 8,440 ft. McCracken discovery, opens Northwest Lisbon field.

Uintah County:
Alamo Corp. 1 Unit, C NE NE 34-8s-24e. IPF 325 M.c.f.d., Wasatch discovery, opens Coyote Wash Unit field. TD 8,530 ft.



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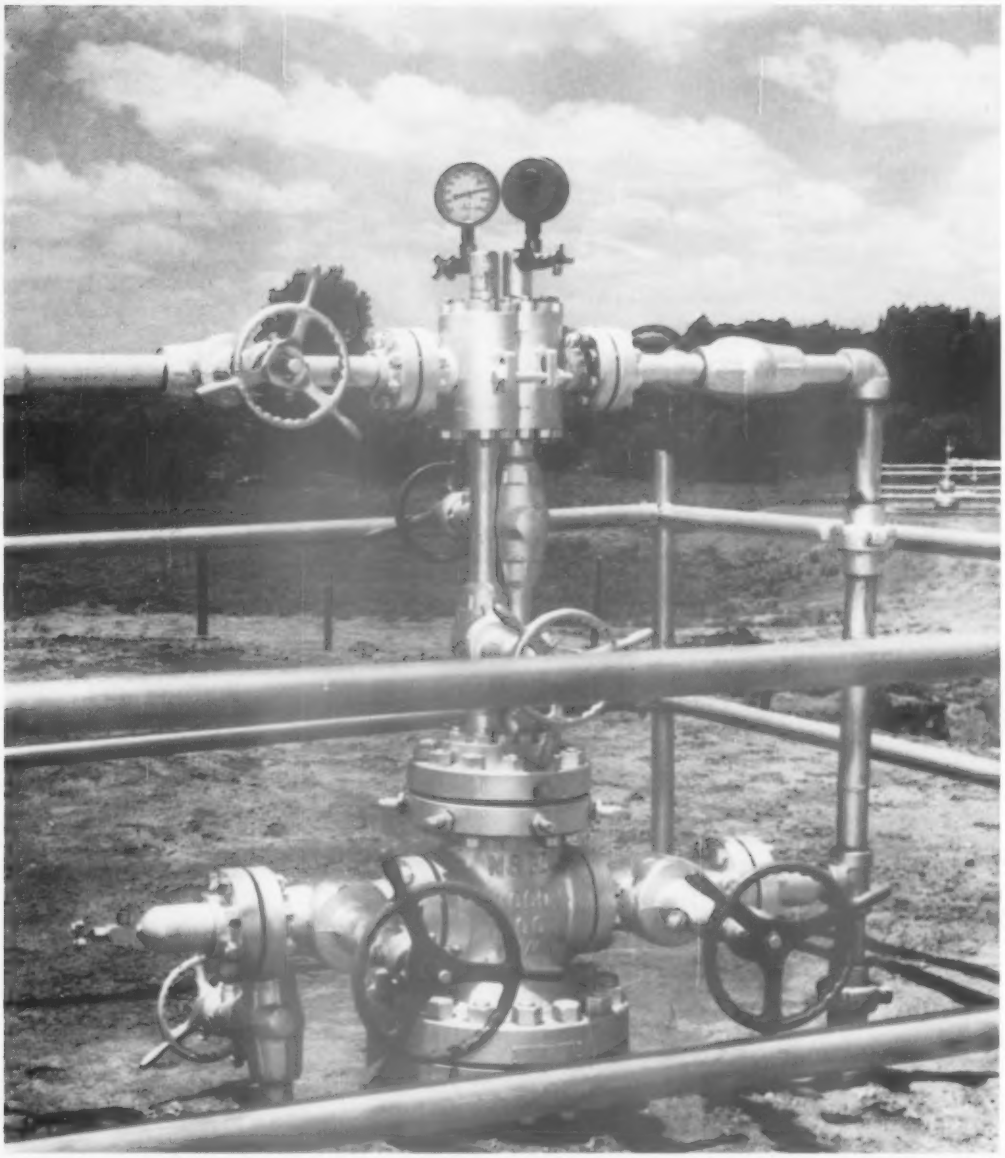

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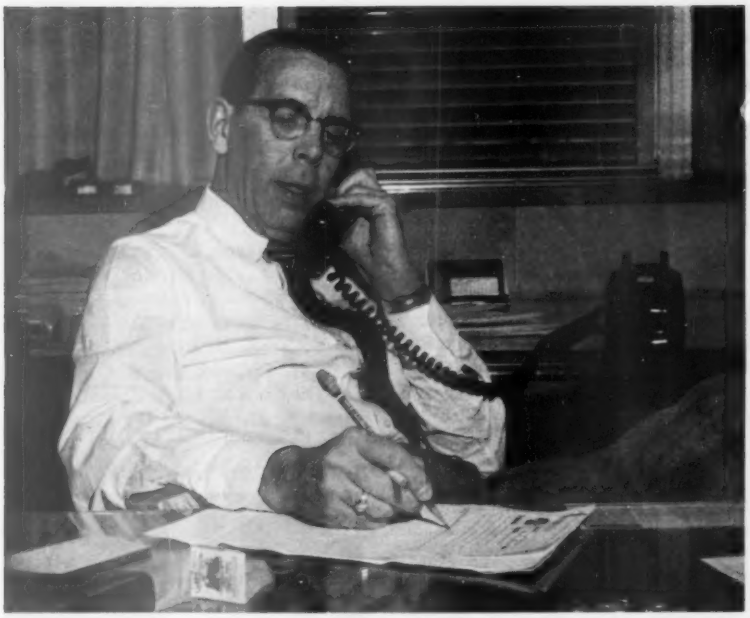


Amerada's Agey
. . . optimistic about future.

Future for Imaginative

. . . and thoughtful geologists, says Charles Agey, new chief geologist for Amerada.

THE OVERSUPPLY situation should lead to some sharper geological work in the future.

That's the view of Charles S. Agey, new chief geologist for Amerada Petroleum Corp.

The petroleum industry, faced with a surplus of geologists in a period of tight economy, is currently reducing its geological payroll. This thinning out process will improve professional standards, Agey believes.

For the most part, he feels, those who remain in the industry will be the geologists who can do the better job.

"Those who stay in geology now—who will not abandon their profession as long as they can scratch a living out of it—are the individuals who have the aptitude to do a really good job," Agey says.

"The profession is still a matter of diligent application," he says. "New correlating tools have been developed, but the good geologist is the one who is able to use more thought or imagination with subsurface data which is available to many.

"The present surplus of geologists is a result of economic conditions. There has been no failure in finding oil and there is plenty more to be found in the United States.

"Some companies see a 5, 10, or 15-year period of oversupply. Personally, I think they are pessimistic. These companies' economic forecasts better be sharp, because it takes time to build an exploration department."

Spurred by student . . . Agey was born in Oakmont, a small town in Pennsylvania. However, his interest in geology did not stem from the fact that his state was the site of the nation's first commercial well.

A fellow student at the University of Rochester, the late Tracy Gillette, stimulated his interest in the subject. Gillette later earned a Ph.D. from Johns-Hopkins University and first entered commercial work as head of Sinclair's foreign operations.

Agey graduated from the University of Rochester in 1933 with a bachelor of science in geology. He was Phi Beta Kappa.

Of course, industry jobs were harder to find then than they are now. Agey found that he could make more money at the University as a laboratory assistant. He took the job and 2 years later earned his master's.

As a result, the circumstances of the depression raised his professional stature. His decision to remain at the university has never been regretted.

When Agey finished his studies, he joined Amerada as a geological scout at Enid. In this job he spent about half of his time checking on wells.

His next post was as district geologist for the company at Wichita. From 1943 to 1946 he served in the U. S. Navy. During this period he was a fighter director officer on an escort carrier in the Pacific.

After his release from the Navy, Agey reopened Amerada's office at Wichita. The following year he opened Amerada's first Rocky Mountain office at Casper.

As district geologist in this area, he was in on the shooting and drilling during the early days of the Williston basin boom.

Agey became assistant chief geologist in 1950. He was named manager of the Canadian division of Amerada in 1956 and assumed his new position as chief geologist last week.

▶▶▶ Personals

V. J. Maruska has joined Humble Oil & Refining Co.'s Carter division as production engineering trainee in Seminole, Okla.

Dr. Ernest W. Thiele, development coordinator at the Whiting, Ind., research laboratories of Standard Oil Co. (Ind.), has retired after 35 years with the company. Thiele will be visiting professor in chemical engineering at the University of Notre Dame next fall.

James L. Rumsey, formerly associate analyst in the coordinating and planning department of Continental Oil Co. in Houston, has joined Delhi-Taylor Oil Corp. in Dallas as administrative assistant in the executive division.

Gerald I. Freeze, engineer with Phillips Petroleum Co. in Caracas, has been transferred to Oklahoma City.

J. H. Pittinger, formerly Houston area geologist for Shell Oil Co., has been named Corpus Christi, Tex., division exploration manager. Pittinger joined Shell in 1949 as a junior geologist. He was area geologist in Tulsa before moving to Houston last year in the same capacity.

Personals

George L. Mateer, vice president, a director, and assistant general manager of Cities Service Refining Corp., has been elected president and general manager of the company. He succeeds **Louis D. Mann,** who has retired. Mateer is also a vice president of Cities Service Research Development Co. and a director of Cit-Con Oil Corp. He has been with the Cities Service companies since 1943 and had been vice president of the refining company since 1955.

MATEER

Ralph B. Hammond, formerly production superintendent for Sooner Oil Co. in Pawhuska, Okla., has been transferred to Tulsa in the same capacity.

Dr. D. R. Frey has been named general manager of the new product development and quality control department of Kerr-McGee Oil Industries, Inc. Others assigned to the new department include **L. W. Okon,** manager of sales technical services; **F. C. Champlin,** chief chemist; and **H. L. Norlin,** laboratory supervisor.

Charles R. Harwood, geophysicist for Ohio Oil Co. in Tulsa, has been transferred to Oasis Oil Co. of Libya in the same capacity. **Dean Seeber** and **Harold Wood,** Ohio geologists in Ardmore, Okla., also have been transferred to Oasis. They will headquarter at Tripoli, Libya.

Rudd G. Seim, Continental-Emsco Co., has been elected chairman of American Petroleum Institute's Illinois Basin chapter. Other officers are **R. N. Ayars,** Ohio Oil Co., first vice chairman; **E. C. Robinson,** V. T. Drilling Co., second vice chairman; and **James A. Hopper,** Halliburton Oil Well Cementing Co., secretary-treasurer.

Bob Harris, senior engineer and examiner in the Texas Railroad Commission's oil and gas division, Austin, Tex., has been named head of the commission's gas department. He succeeds **John Cameron,** who has resigned to join Tidewater Oil Co. in Houston. Cameron will handle proration and unitization work for Tidewater in Texas, New Mexico, Oklahoma, Louisiana, and Kansas.

B. B. Bolton, formerly gas reservoir engineer for Magnolia Petroleum Co. in Dallas, has been named production engineer for Mobil Oil Co. in Eagle Lake, Tex.

Bruce O. Holman, formerly natural gas engineer with Mobil Oil Co. in Wharton, Tex., has been transferred to Bay City, Tex., as production engineer.

Dale M. Robinson, drilling engineer for Atlantic Refining Co. in Oklahoma City, has been promoted to district production and drilling foreman and transferred to Great Bend, Kans.

Eugene E. Kincaid, Tyler, Tex., petroleum engineering consultant, has joined T. W. McGuire & Associates, Shreveport, La., consulting firm. Kincaid was with Carter Oil Co. and Murphy Corp. before going into consulting work.

E. J. Reading, Sun Oil Co., has been elected president of the Indiana Oil and Gas Association. Other new officers include **John Buchman,** independent, first vice president; **John C. Hall,** Sohio Petroleum Co., vice president; and **J. D. Turner,** independent, secretary-treasurer.

W. F. Herbert, Jr., mechanical engineer in Shell Oil Co.'s Houston production division, has been transferred to Quitman, Tex., as mechanical engineer. **J. W. Shelton,** Shell geologist in Denver, has been transferred to Houston. **P. J. Gratton,** junior geologist in Houston, has been named geologist in Tyler, Tex.

D. H. McClure, formerly in the Baton Rouge refinery of Humble Oil & Refining Co.'s Esso Standard division, has been named assistant manufacturing coordinator for Enjay Co., Inc. **D. W. Pugh,** formerly on loan to Esso Research Laboratories, has been named division foreman in the butyl department at the Baton Rouge refinery.

Robert K. Hoffman, formerly assistant superintendent of cracking at the No. 1 Cleveland refinery of Standard Oil Co. (Ohio), has been appointed chief process engineer at the refinery. He succeeds **David P. Handke** who has moved to the home office process engineering department. At Ohio Standard's No. 2 refinery, Cleveland, **Duane Switzer,** chief process engineer, has succeeded **Richard Foss** as senior technical specialist, manufacturing operations staff. Foss will take over Switzer's post at the refinery.

J. Ruinen, project engineer with J. Ray McDermott & Co., Inc., has been transferred to New Orleans from Houston.

Fred E. (Sam) Stickle, formerly vice president and general manager of Stickle Drilling Co., has been named president. He succeeds **Frank Stickle.**

H. L. Ward, district manager in Tyler, Tex., for Drilling & Service, Inc., has been transferred to Shreveport, La., in the same capacity.

E. G. Collado, treasurer of Standard Oil Co. (N. J.), and **J. R. White,** president of Imperial Oil Ltd., Jersey subsidiary, will be candidates for election to the Jersey board of directors

COLLADO

WHITE

at the company's annual meeting May 25. Collado was with the State Department, the Treasury, and the Federal Reserve Bank of New York before joining Jersey in 1947. He was named treasurer in 1954. White joined Imperial in 1933. He moved to Jersey in New York in 1937 and then to Creole Petroleum Corp. in Venezuela. He is a former vice president of Creole. He rejoined Imperial in 1944, becoming executive vice president in 1950 and president in 1953.

N. E. Tanner, former president and chairman of Trans-Canada Pipe Lines, Ltd., has been named president of Merit Oil, Ltd., Calgary. **Clifford R. Walker,** formerly vice president of Pacific Petroleums, Ltd., is vice president and general manager of Merit.

J. H. Frerich, formerly vice chairman of the Montana Oil and Gas Conservation Commission, has been named commission chairman and official representative of **Gov. J. Hugo Aronson** on the Interstate Oil Compact Commission.

J. W. (Win) Miller, executive representative of Union Oil Co. in San Francisco, has retired after 24 years with the company. Miller is a former Los Angeles division manager and southwest territory manager for Union. He also has been executive president of Brea Chemicals, now Collier Carbon & Chemical Corp.

▶▶▶ Personals

William C. Thrailkill, assistant superintendent of Transcontinental Gas Pipe Line Corp.'s gas control department, has been promoted to superintendent of the department. He succeeds **C. M. Springer,** who is on leave of absence with Fish Engineering Corp. in Argentina. Thrailkill has been with Transco since 1950.

Robert W. Young, chief engineer at Great Lakes Pipe Line Co.'s Paola, Kans., station, has been named chief engineer of the West Tulsa station. He succeeds **Sam Ritterbush,** who has retired.

Burdette M. King, assistant superintendent of Ohio Fuel Gas Co.'s compressor department, has been promoted to compressor department superintendent. He succeeds **Albert E. Bradbury,** who has retired after 32 years with the company. **Clarke Kiner,** general engineer in the compressor department, has succeeded King as assistant superintendent.

Ralph S. Williams, transmission engineer with Columbia Gulf Transmission Co., has been named measurement superintendent for the company. He succeeds **Bruce J. Caldwell,** who has resigned. **Howard S. Wright,** design engineer with the company, has been named transmission engineer.

L. A. Valentine, assistant superintendent in Panhandle Eastern Pipe Line Co.'s Pittsfield, Ill., district, has been promoted to superintendent of the Mexico, Mo., district. He succeeds **J. T. Lewis,** who has retired. **Robert G. Herrick,** formerly in Crawfordsville, Ind., will succeed Valentine in Pittsfield.

Bob Bradshaw, vice president of Warren-Bradshaw Exploration Co. before its sale to Sunset International Petroleum Corp., has formed Kiska Oil Co. in Tulsa.

Enrico Mattei has been reappointed president of Ente Nazionale Idrocarburi, Italian state oil agency. He was named to the post for the 1960-63 term by the Ministry of State Participations.

A. C. Rubel, president of Union Oil Co., will retire April 26 after 37 years with the company. **Reese H. Taylor,** chairman, is expected to become chairman and president. Rubel will continue with Union as a director and member of the executive committee. He will also be available for special assignments. Rubel has been president of the company since 1956.

James R. Paul, formerly district operations manager in Evansville, Ind., for Dowell Division of Dow Chemical Co., has been transferred to Denver as general sales engineer.

Kirby Hillin, assistant division civil engineer for Sun Oil Co. in Dallas, has been promoted to southwest production division civil engineer. He succeeds **Arch Clark,** who has retired.

J. W. Scott has been appointed division supervisor of the petroleum process development division at California Research Corp.'s Richmond, Calif., laboratory.

Dr. R. F. Fischer, research supervisor in Shell Development Co.'s Emeryville, Calif., research center, has been given a 2-year assignment as technical assistant for chemicals to **Dr. H. Gershinowitz,** Shell Development Co. president, in New York.

A. E. Oldham, Dallas independent geologist, has been elected a director of Aztec Oil & Gas Co., Dallas. **Quilman B. Davis,** secretary and general attorney for Aztec, has been promoted to vice president and general attorney. **Arland L. Ward,** treasurer, has been promoted to secretary and treasurer.

Jerol M. Sonosky, formerly senior petroleum engineer with Superior Oil Co. in Los Angeles, has joined the California Bank in Los Angeles as senior petroleum engineer. Sonosky also had been with Shell Oil Co. in the Rocky Mountain, California, Gulf Coast, and West Texas areas.

F. B. Conger, geologist with Shell Oil Co., has been transferred from the Pacific Coast area to the Houston exploration and production research division.

Bryant W. Bradley, division mechanical engineer in Ventura, Calif., for Shell Oil Co., has been transferred to Los Angeles as area chemical engineer.

Richard C. Shelton, district geologist with Ohio Oil Co. in Durango, Colo., has been transferred to Casper, Wyo. **Fred Spindle,** formerly in Casper, will succeed Shelton in Durango.

E. Sanford Bills has been named manager of Signal Oil & Gas Co.'s Hancock marketing division. He succeeds **Joe W. Perry,** who has resigned. **Fred O. Graham** will succeed Bills as manager of Hancock's southern division. Graham was formerly manager of the northern division.

S. A. Spencer, Phillips Petroleum Co., has been elected 1960 president of the Lafayette, La., Geological Society. Other new officers are **Adam Perez,** Schlumberger Well Surveying Corp., vice president; **W. S. McAlister,** Texas Eastern Transmission Corp., secretary; and **Julian Morgan,** Tidewater Oil Co., treasurer. Executive committee members include **E. V. Harrison,** Sunray Mid-Continent Oil Co.; **William W. Henry,** Union Oil Co.; and **Jack P. Martin,** consultant.

LOS ANGELES NOMADS' new president, Taylor Bannerman, right, of Technical Oil Tool Corp., takes over the chapter gavel from Tom R. Ashe, Globe Oil Tools Co., retiring president.

W. D. Seyfried, head of the research and development division at Humble Oil & Refining Co.'s Baytown, Tex., refinery, has been appointed manager of research for Humble, a new position. He will coordinate all scientific research carried out by the company. Also **Dr. H. Dayton Wilde,** formerly research coordinator for the Humble division, has been appointed university relations counselor for Humble Oil & Refining. Wilde has been with Humble since 1927 and has been research coordinator since 1957. Seyfried joined the company at Baytown in 1938.

SEYFRIED

E. L. Chapin, petroleum engineer with Pan American Petroleum Corp., has been transferred to Tyler, Tex., from Longview, Tex.

William F. Cerini, southern division reservoir engineer for Union Oil Co. in Santa Fe Springs, Calif., has been promoted to staff engineer, Pacific Coast area, in Los Angeles.

Forrest A. Garb has been elected vice president and a director of H. J. Gruy & Associates, Inc., Dallas consulting firm. Garb has been with the company since 1957. He was with Socony Mobil Oil Co. and its affiliates before that time.

Dr. Adalbert Farkas, formerly head of Houdry Process Corp.'s organic research section, has been named assistant director of research for the company. Farkas was with Union Oil Co. and Barrett division of Allied Chemical Corp. befor joining Houdry in 1956.

B. J. Tabor, formerly drilling superintendent for Jennings Drilling Co., Hobbs, N. M., and **J. R. McLaughlin,** formerly production superintendent for Janlyn Oil Co., Inc., Magnolia, Ark., have formed Tabor & McLaughlin, Inc., contract drilling firm. Headquarters are in Glasgow, Ky.

Steven H. Harris, Harris & Brown, Bismarck, N. D., has been elected president of the Dakota Petroleum Club. Other new officers are **Charles Skjod,** Amerada Petroleum Corp., vice president; **Leroy Blaylock,** Bismarck, secretary; and **Tom Keating,** Mobil Oil Co., treasurer. Directors include **R. W. Killen,** The California Co.; **Norman Lestina,** Gulf Oil Corp.; and **Woodrow Wilson,** Ohio Oil Co.

L. E. Kennedy, supervisor for Texaco Inc., has been transferred to Winfield, Kans., from El Dorado, Kans.

Joseph R. Enbe, Jr., petroleum engineer with Amerada Petroleum Corp., has been transferred to Midland, Tex., from Williston, N. D.

C. T. Evans, district petroleum engineer with Mobil Oil Co. in Hobbs, N. M., has been promoted to district engineer in Wichita Falls, Tex.

Preston L. Meeks, gas engineer with Mobil Oil Co. in Alice, Tex., has been transferred to Corpus Christi, Tex., as production engineer.

Ralph W. Jackson, junior petroleum engineer with Sinclair Oil & Gas Co., has been transferred to Tulsa from Drumright, Okla.

F. J. Kerth, formerly division representative for Union Oil Co. in Anchorage, Alaska, has been named Alaska sales manager.

William E. Harris, formerly with International Petroleum Co. in Talara, Peru, has been transferred to Tulsa as research engineer with Jersey Production Research Co.

C. W. Ledebur has been appointed vice president in charge of exploration for Forest Oil Corp., Bradford, Pa. Ledebur has been with Forest since 1930.

J. A. Harvie, manager of the exploration and production division of Royalite Oil Co., Ltd., has been elected vice president and a director of Madison Natural Gas Co., Ltd., a Royalite subsidiary. Harvie has been with Royalite since 1946. He took leave to act as vice president and general manager of Producers Pipelines, Ltd., in 1957, and returned to Royalite last year as manager of exploration and production. He will continue in this post with the parent company.

J. E. Ferguson, tool pusher with Superior Oil Co., has been transferred from Conroe, Tex., to Raymondville, Tex., as production foreman.

Billy F. Burke, reservoir engineer with Humble Oil & Refining Co., Carter Division, in Shreveport, La., has been transferred to Denver as senior engineer.

James Eads, formerly general superintendent for Superior Oil Co. in Crossville, Ill., has been transferred to Lafayette, La., as assistant general superintendent.

William A. Adent has been named western division exploration manager for Wico Oil Co., Oklahoma City. He will headquarter in the company's new Sacramento, Calif., office.

W. L. Martin has been promoted to staff engineer in the technical division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. **H. A. Ward, Jr.,** has been named senior mechanical engineer, technical division, in Baytown.

R. B. Warren, Jr., president and general manager of Warren-Bradshaw Exploration Co. before its sale to Sunset International Petroleum Corp. last year, has formed the R. B. Warren Co. in Tulsa.

R. G. McCuistion, formerly in the Midland, Tex., regional office of Empire Geophysical, Inc., has been transferred to Farmington, N. M., as supervisor of field operations and seismic interpretation in the Four Corners area.

Bob Gilmour, British American Oil Co., Ltd., has been elected president of the Saskatchewan Oilfield Technical Society. Other new officers are **Val Eschelman,** British American, vice president; **Chuck McCullough,** Shell Oil Co. of Canada, Ltd., secretary; and **Bob Appleton,** Imperial Oil Ltd., treasurer.

▶▶▶ Deaths

Samuel H. Pope, 54, mechanical engineer for Gulf Oil Corp. in Houston, died March 2 in a Houston hospital after a short illness. Pope had been with Gulf since 1927.

Michael Joseph Flanagan, 78, president of Gaso Pump & Burner Manufacturing Co., and Tulsa Iron Works, died March 1 at his Tulsa home after suffering a cerebral hemorrhage. Flanagan was one of the founders of Gaso Pump in 1916. He had been president of the firm since 1945.

John Floyd Waters, 70, retired superintendent of pipeline stations in Amarillo, Tex., for Phillips Petroleum Co., died February 27 at his home in Tulsa. Waters was with Phillips 33 years before retiring in 1955.

(Continued from page 143)

Cyrus V. Helm assumes post

. . . of administrative assistant to Walter Beadle, executive vice president of Western Co., oil-well-servicing concern with general offices at Fort Worth. Helm will be responsible for evaluating and formalizing the company's planning functions, as well as coordinating the administrative functions of Beadle's department.

A 12-year veteran with Western, Helm has served as treater, district engineer, station manager, chief of field operations engineering, Midland division manager, and most recently, as manager of industrial relations.

Thomas M. Byrd takes over

. . . as assistant manager of Kaiser Steel Corp.'s southern district sales office in Los Angeles, announces C. F. Cooper, assistant general sales manager. Byrd succeeds Fred G. Brear who was recently appointed manager of customer services at the company's home offices in Oakland. Byrd has been with the southern district sales office since he joined Kaiser in 1951. He was appointed a senior sales representative in 1954 and served in that capacity until the present.

William O. Jacobs is appointed

. . . western sales representative by M. W. Kellogg Co., New York engineering-procurement-construction firm specializing in refinery and chemical-plant design and construction. Jacobs has offices in Los Angeles.

John L. Holmquist is director

. . . of research—tubular products, for National Supply Co. He will locate at the company's general offices in Pittsburgh and will be responsible for research and development on both seamless and welded tubular products.

At the same time, Thomas L. Blose was appointed director of product engineering at Ambridge, Pa., succeeding Holmquist, and Lawrence W. Peugeot was named assistant chief engineer succeeding Blose.

Holmquist started at the Ambridge plant in 1931 as assistant metallurgist, later becoming chief metallurgist. He was appointed director of research in 1940.

Blose started at the Ambridge plant in 1933 as an inspector, and was promoted to research engineer in 1941. After serving 6 years with another company, he returned to National Supply in 1957 and was appointed assistant chief engineer at the Ambridge plant in 1958.

Peugeot joined National Supply in 1946 as assistant to the plant engineer at the Toledo plant. He was promoted to assistant plant engineer in 1950, plant engineer in 1952, and superintendent of plant maintenance in 1958. He was transferred to Ambridge following closing of the Toledo plant last September.

Seismic recording system is sold

. . . by Southwestern Industrial Electronics Co. to each of the following companies: Asiatic Petroleum, New York City; Geophysical Associates International, Houston; and Gewerkschaft Brigitta, Hanover, Germany. The PMR-20 RecorData portable FM magnetic recording system is a 24-channel transistorized system complete in two compact, lightweight units.

Honeywell names J. W. Hughes

. . . sales manager of its Valve Division at Fort Washington, Pa., and appoints C. D. McIntire to succeed him as industrial manager of its Midwest region in Chicago.

J. W. Hughes

C. D. McIntire

Hughes joined Minneapolis-Honeywell Regulator Co. in 1946 as an industrial sales engineer in the Birmingham branch office. He was manager there from 1950 to 1952. He later became industrial sales manager of the Chicago branch office before taking over as Midwest regional industrial sales manager.

McIntire has been with Honeywell's Brown Instruments Division since 1941, filling assignments in Philadelphia, Cincinnati (where he was a sales engineer and later branch manager), and in Birmingham, as branch manager.

Atlas Pipe Inc. approves merger

. . . with Bradford Supply Co., Bradford, Pa. At the close of a special meeting of Atlas Pipe stockholders, W. H. (Buster) Becker, president of Atlas Pipe, of Houston, and Donald W. Mackie, Jr., president of Bradford, announced the formation of Atlas Bradford Co., a Texas corporation. The merger had been approved previously by Bradford stockholders.

Bradford was formed in 1907. At present the company has 16 branches and 5 shops serving industry from Texas to New York. While basically the company's role is that of hardware merchant to the oil industry, recent years have seen emphasis placed on engineering service to customers.

Atlas Pipe was founded in June 1950. Today it has two wholly owned divisions, Hardy-Griffin Engineering Corp., and Universal Inspection & Service Co.

James W. Young assumes post

. . . of assistant division manager of Maloney-Crawford Tank & Mfg. Co., announces R. C. Schenk, president. Formerly branch manager in Lafayette, La., Young will remain in Lafayette to take charge of the company operations in Arkansas, Mississippi, and Alabama.

J. W. Young

F. D. Sides is representative

. . . in the Panhandle and West Texas area of Victaulic Co. of America, reports J. B. St. Clair, general sales manager of the Elizabeth, N. J. concern. Sides will operate from the firm's warehouse and office in Odessa under the supervision of M. R. (Mike) Huffman, Victaulic's Mid-Continent district manager. Before joining Victaulic, Sides was district manager of Diamond Oil Well Drilling Co. in Abilene, and also worked with Sivalls Tanks in Odessa.

Moran Tank Co. announces

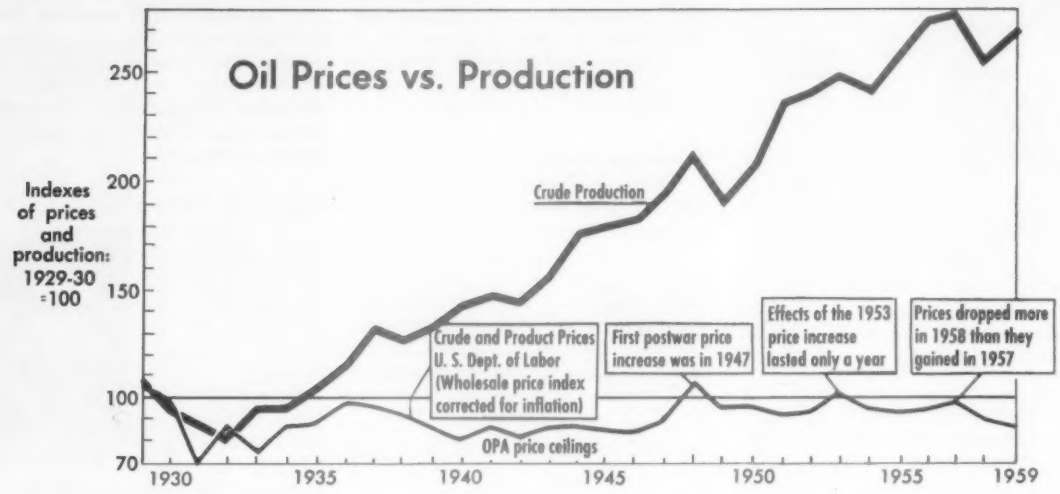
. . . plans for establishing a new warehouse and storage yard at New Orleans. The report came from Frank Moran, president, at the Shreveport company's annual sales meeting. Speaking to sales representatives from a 3-state area, Moran said the new installation, to cost about $35,000, would be completed in about 4 months. Gene Batterton will be in charge of the facility.

R. H. Neustaedter is named

. . . location manager for Gainesville, Tex., and B. F. Irvin is appointed sales engineer at Shawnee, Okla. by Schlumberger Well Surveying Corp. Neustaedter formerly served as a sales engineer for the firm in Tyler, Tex., while Irvin held an assignment as field engineer general in Shawnee.

Bradford Motor Works appoints

. . . Zeb Land as sales representative at Electra, Tex. Land was formerly field representative for National Supply Co. at Pampa, Tex. He has more than 9 years' experience in oil-well pump application and repairs.



Oil lags in the price parade

BY JOHN C. CASPER

MEASURED in constant-value dollars, crude and product prices in 1959 were at the lowest level of the past 13 years.

Oil industry's increases in real income have been due to gains in volume. Prices in constant dollars have tended to be low for the past 30 years.

Take a look at growth in volume since 1929. Both price and volume are expressed as indexes with 1929-30 equal to 100.

Note that crude production dropped below the 1929-30 average during the early depression years of the thirties but climbed above the base average in 1935. Except for the slight reduction in 1942 which was caused by early war restrictions, the dips in crude production have coincided with the recession years. Note the drops that occurred in 1938, 1949, 1954, and 1958.

The period of maximum growth was from 1932 through 1956. Gains in crude production averaged 5.1% a year. Total increase was from 2,145,000 bbl. daily in 1932 to 7,151,000 bbl. daily in 1956.

Crude production for 1960 will establish a new record. Demand for the first 2 months of the year has been a little under normal because of the weather, but production for the year probably will be near 7,350,000 bbl. daily.

Gains in over-all crude and product prices show up in those years when crude prices were raised. This seems to indicate that refiners have raised product prices only when higher crude prices have increased over-all costs.

The price line on the chart is taken from the Department of Labor's wholesale price index for petroleum and products. It has been corrected for inflation, using the wholesale price series for all commodities other than farm products and food.

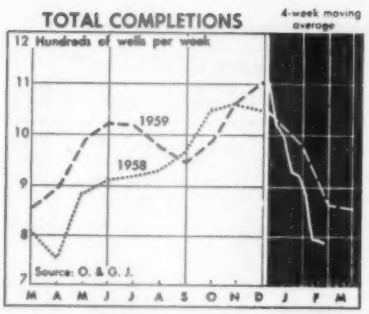
Price ceilings during World War II caught the oil industry with subnormal postings for crude products. For example, the ceiling price for 36°-gravity Oklahoma crude was set at $1.17 a barrel by OPA on October 1, 1941. Price ceilings were removed in July 1956, but crude and product increases for the year were more than offset by inflation which followed. The first true price gain came in 1957.

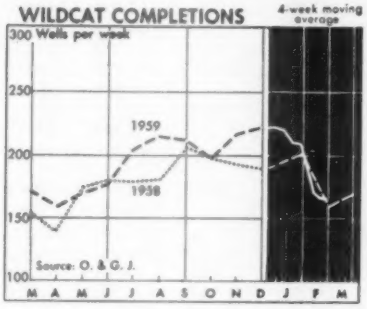
Crude prices were raised three times in 1947, but the last two were near the end of the year. The effect of these late price increases did not show up until 1948. Note that true crude and product prices topped the 1929-30 average that year. However, general inflation put oil prices back below the line again in 1949.

The price increase of 1953 helped a little but only enough to push oil back up to the base line for that one year. The indictment-producing price increase of 1957 didn't even bring the average up to the base line, and crude and product prices for 1959 were down to 88.3% of the 1929-30 average. Oil doesn't seem to be able to keep pace with the general price advance.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,332,540	UP	3,180	UP	130,400
Crude stocks	251,616,000	UP	2,700,000	DOWN	3,644,000
Completions	795	DOWN	35	DOWN	70
Refinery runs	8,108,000	UP	27,000	DOWN	128,000
Gasoline stocks	215,623,000	UP	2,681,000	UP	7,879,000
Kerosine stocks	21,878,000	DOWN	1,109,000	UP	2,285,000
Distillate stocks	108,815,000	DOWN	3,782,000	UP	27,181,000
Residual stocks	45,299,000	DOWN	1,122,000	DOWN	9,283,000
Four-product stocks	391,615,000	DOWN	3,332,000	UP	28,062,000
Total imports	1,896,800	DOWN	195,200	UP	406,400





Active Rotary Rigs

	2-29-60	2-22-60	3-2-59
Alabama	4	3	9
Arkansas	17	14	15
Arizona	1	1	0
California	80	74	85
Land	75	69	82
Offshore	5	5	3
Colorado	22	26	30
Florida	1	1	1
Land	0	0	1
Offshore	1	1	0
Illinois	21	19	14
Indiana	4	4	5
Iowa	0	1	3
Kansas	91	96	129
Kentucky	5	5	3
Louisiana	282	290	296
North	25	27	21
S. Inland waters	125	111	137
S. Land	85	94	102
Offshore	47	58	36
Maryland	0	0	1
Michigan	37	34	17
Mississippi	69	79	51
Missouri	1	1	0
Montana	12	12	19
Nebraska	23	24	26
Nevada	0	0	0
New Mexico	94	90	99
New York	0	0	0
North Dakota	8	13	34
Ohio	3	3	3
Oklahoma	196	187	213
Oregon	0	0	0
Pennsylvania	8	9	12
South Dakota	0	0	1
Texas	595	615	705
S. Inland waters	8	3	9
S. Land	167	171	124
Offshore	0	0	1
North	38	44	145
East	48	53	(*)
Panhandle	45	56	(*)
West Central	194	192	266
West	95	96	160
Utah	28	29	38
Washington	0	0	0
West Virginia	4	3	3
Wyoming	54	50	48
Total U. S.	1,660	1,683	1,860
Western Canada	248	255	232
Eastern Canada	4	4	0
Grand total	1,912	1,942	2,092

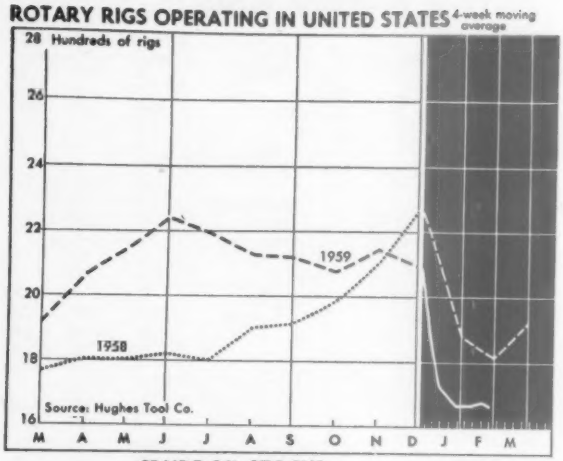
Hughes Tool Co. report. *Included in north. Comparisons not available due to change in method of reporting.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 27, 1960

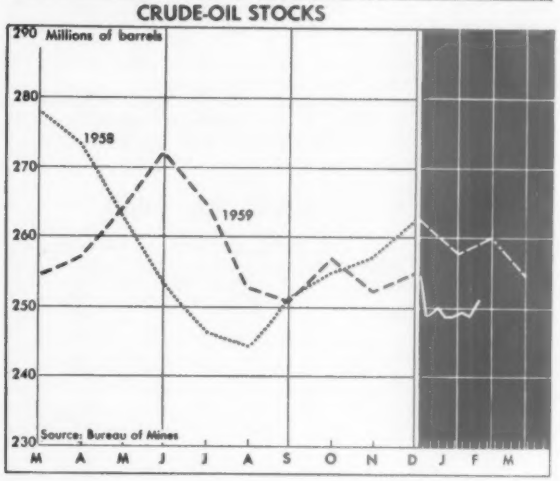
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	8	21	0	0	0	0	0	1	3
Arizona	0	0	0	0	0	0	0	6	.....	0	0	0	0	0	6	.....
Arkansas	16	5	0	2	9	0	56,334	108	169	5	0	0	1	4	29	29
California	19	10	0	0	8	1	94,096	209	275	7	0	0	0	7	50	65
Colorado	9	2	0	2	5	0	44,920	119	127	5	1	0	1	3	60	65
Illinois	33	13	0	0	20	0	68,166	436	406	14	0	0	0	14	111	66
Indiana	11	2	0	0	9	0	14,660	158	120	7	1	0	0	6	60	37
Kansas	57	27	1	4	25	0	220,384	574	671	18	3	0	1	14	179	156
Kentucky	29	9	0	5	9	6	43,213	354	288	4	0	0	0	4	44	34
Louisiana	48	17	5	4	21	1	390,382	537	608	8	1	0	0	7	72	88
North	13	4	0	2	7	0	66,559	178	222	1	0	0	0	1	30	45
South	31	11	4	2	13	1	276,629	273	327	7	1	0	0	6	37	42
Offshore	4	2	1	0	1	0	47,194	86	59	0	0	0	0	0	5	1
Michigan	16	11	0	0	3	2	55,384	121	92	1	0	0	0	1	41	27
Mississippi	19	8	1	0	10	0	188,199	123	108	8	0	0	0	8	47	54
Montana	4	3	0	0	1	0	17,825	44	52	0	0	0	0	0	22	20
Nebraska	11	4	0	0	7	0	56,842	117	107	5	2	0	0	3	46	48
New Mexico	32	25	0	4	3	0	149,885	328	284	2	0	0	0	2	43	25
West	10	6	0	4	0	0	37,309	111	.....	0	0	0	0	0	9	.....
East	22	19	0	0	3	0	112,576	217	.....	2	0	0	0	2	34	.....
New York	22	13	0	0	2	7	29,700	72	52	0	0	0	0	0	5	1
North Dakota	11	8	0	0	3	0	62,424	51	75	1	0	0	0	1	8	21
Ohio	23	9	0	7	7	0	67,929	209	145	2	0	0	1	1	12	4
Oklahoma	66	27	0	11	24	4	291,262	634	966	12	2	0	2	8	123	156
Pennsylvania	0	0	0	0	0	0	0	67	59	0	0	0	0	0	5	1
South Dakota	3	1	0	0	2	0	18,461	7	.....	1	0	0	0	1	3	.....
Texas	320	165	15	15	109	16	1,366,837	2,661	3,133	58	2	1	1	54	557	609
Dist. 1	22	8	1	0	11	2	75,611	194	222	9	0	0	0	9	75	58
Dist. 2	15	3	2	6	4	0	83,915	113	129	3	0	0	1	2	29	40
Dist. 3	19	6	1	0	12	0	146,734	219	185	5	0	0	0	5	44	55
Dist. 4	22	4	5	3	10	0	133,266	222	230	3	0	1	0	2	63	64
East	15	9	1	0	5	0	71,600	211	190	5	0	0	0	5	45	45
Dist. 7-B	48	23	0	0	24	1	116,856	364	386	12	1	0	0	11	104	120
West	86	65	3	0	18	0	430,250	705	979	10	0	0	0	10	114	106
Dist. 9	60	31	1	3	17	8	166,015	460	580	7	0	0	0	7	71	95
Dist. 10	33	16	1	3	8	5	142,590	173	232	4	1	0	0	3	12	26
Utah	1	1	0	0	0	0	5,751	43	64	0	0	0	0	0	16	17
West Virginia	15	0	0	13	2	0	28,745	141	120	0	0	0	0	0	1	4
Wyoming	29	8	0	1	20	0	123,672	163	141	11	0	0	0	11	66	57
Misc. (Fla.)	1	0	0	0	1	0	12,076	5	13	1	0	0	0	1	4	10
Total U. S.	795	368	22	68	300	37	3,407,147	7,295	8,096	170	12	1	7	150	1,611	1,597
Previous week	830	345	19	106	316	44	3,322,914	.....	.....	166	24	1	6	135	.....	.....
Cum. 1960	7,295	3,383	232	656	2,781	243	31,388,281	.....	.....	1,611	152	15	52	1,392	.....	.....
Cum. 1959	8,096	4,068	205	550	3,063	210	34,171,762	.....	.....	1,597	172	20	57	1,348	.....	.....
Western Canada	42	23	0	2	17	0	228,929	353	364	11	1	0	1	9	96	134

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	2-20-60	2-13-60	2-21-59
Pennsylvania	2,311	2,330	2,539
Other Appalachian	1,883	1,873	1,336
Illinois, Indiana, Michigann	9,525	9,792	9,383
Nebraska and North Dakota	2,710	2,560	2,169
Kansas	9,437	9,335	9,351
Oklahoma	16,870	16,950	16,523
Arkansas	2,075	2,187	1,887
Louisiana	18,782	18,867	17,851
North	2,885	2,972	2,872
South	15,897	15,895	14,979
Mississippi, Alabama, Florida	2,667	2,251	2,254
New Mexico	7,565	7,359	8,762
Texas	106,841	105,834	113,809
East Texas	7,724	8,114	8,631
West Texas	50,255	49,254	56,011
Texas Gulf	18,742	19,105	20,500
Other Texas	30,120	29,361	28,667
Wyoming	17,589	17,355	12,632
Other Rocky Mountain	9,047	9,255	9,153
California	29,053	28,595	34,587
Foreign	†15,261	14,373	13,024
Total	**251,616**	248,916	255,260

*Bureau of Mines. †Includes 4,438,000 bbl. in California.

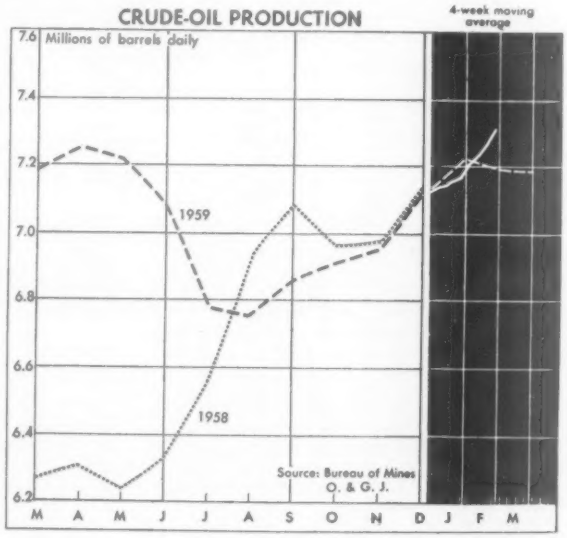
DAILY AVERAGE PRODUCTION FOR WEEK

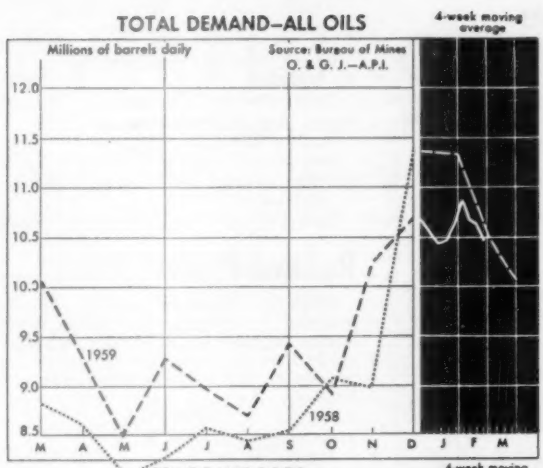
	February 27, 1960			Feb. 20
	Crude oil	Lease condensate	Total	total
Alabama	19,300		19,300	19,200
Arkansas	84,250	300	84,550	84,475
California	826,300		826,300	827,700
Colorado	130,000		130,000	129,300
Eastern	38,400		38,400	40,300
Florida	1,150		1,150	1,150
Illinois	214,600		214,600	211,500
Indiana	36,000		36,000	33,200
Kansas	†318,340		†318,340	†324,360
Kentucky	67,900		67,900	66,000
Louisiana	957,225	132,625	1,089,850	1,089,775
North	109,225	6,125	115,350	115,275
South	848,000	126,500	974,500	974,500
Michigan	28,800		28,800	28,500
Mississippi	140,000	5,025	145,225	145,225
Montana	77,600		77,600	78,000
Nebraska	63,800		63,800	63,500
Nevada	100		100	100
New Mexico	297,900	6,700	304,600	304,600
North Dakota	60,000		60,000	59,900
Oklahoma	†567,800		†567,800	†563,150
Texas	2,706,000	90,225	2,796,225	2,796,225
Dist. 1	41,000	3,800	44,800	44,800
Dist. 2	119,000	9,200	128,200	128,200
Dist. 3	355,000	38,500	393,500	393,500
Dist. 4	190,000	15,800	205,800	205,800
Dist. 5	27,000	500	27,500	27,500
Dist. 6	119,000	9,400	128,400	128,400
East Texas field	147,000		147,000	147,000
Dist. 7-B	139,000	200	139,200	139,200
Dist. 7-C	130,000	3,625	133,625	133,625
Dist. 8	1,139,000	5,600	1,144,600	1,144,600
Dist. 9	192,000	2,200	194,200	194,200
Dist. 10	108,000	1,400	109,400	109,400
Utah	110,900		110,900	110,500
Wyoming	349,800		349,800	351,400
Others	‡1,300		‡1,300	‡1,300
Total U. S.	7,097,665	234,875	**7,332,540**	7,329,360
Change from previous week, up			**3,180**	
Canada	†578,000		†578,000	†590,000

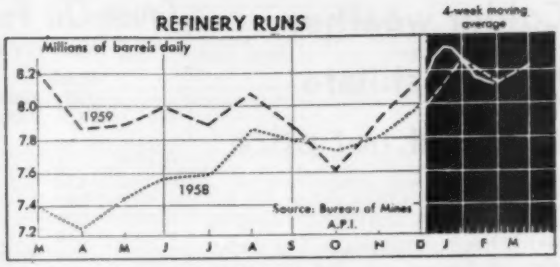
Total U. S. production—Jan. 1-Feb. 27 ..... 419,796,200 bbl.
Same period last year (crude plus cond.) ..... *418,158,800 bbl.

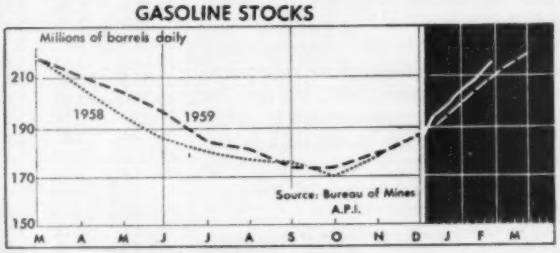
*Includes 11,300,600 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

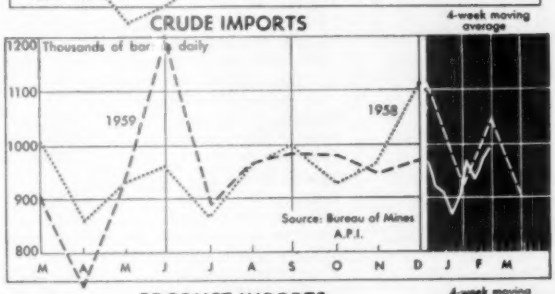
CRUDE-OIL PRODUCTION

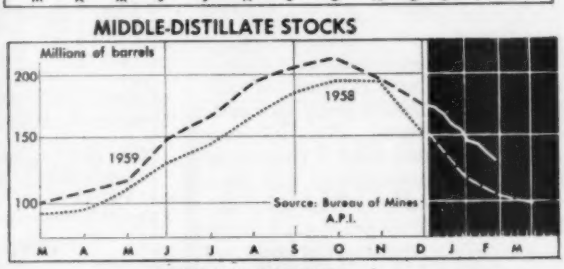


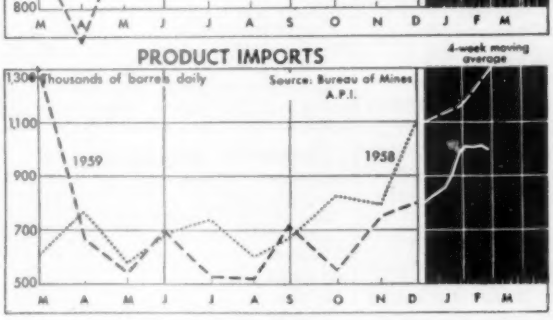

TOTAL DEMAND–ALL OILS
4-week moving average
Millions of barrels daily
Source: Bureau of Mines O. & G. J.—A.P.I.
1959
1958
M A M J J A S O N D J F M

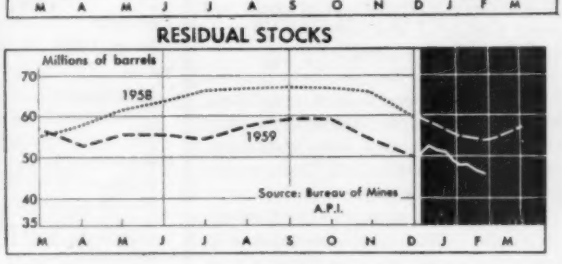












API REFINERY REFORT—FEBRUARY 26, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.	Stocks‡: Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1959: Daily avg. runs	Daily average production: Gaso.*	Kero.	Dist.	Resid.
East Coast	1,141	565.3	18.1	361.0	173.3	44,258	8,953	39,574	12,467	1,223	562.0	50.8	437.5	217.9
Appalachian:														
District 1	104	44.3	4.0	19.0	14.9	6,132	557	2,694	301	101	41.2	6.6	24.1	13.0
District 2	105	54.6	8.3	16.7	16.4	3,069	383	1,151	376	115	55.9	9.9	21.9	17.1
Ind., Ill., Ky.	1,478	750.1	58.1	294.8	187.0	41,293	4,182	17,754	4,660	1,505	714.3	81.3	381.6	234.0
Minn., Wis., Dak.	110	40.1	6.0	32.3	17.4	7,112	773	4,985	582	104	52.1	5.8	26.1	12.9
Okla., Kans., Mo.	743	412.4	12.9	195.9	32.0	21,924	944	8,844	1,003	778	419.4	16.9	225.5	38.8
Inland Texas	275	183.9	11.7	32.0	19.6	8,278	460	1,336	2,417	290	196.2	8.9	51.0	22.3
Tex. Gulf Coast	1,893	938.9	100.0	490.0	149.3	27,998	2,338	11,749	5,208	1,775	807.9	139.4	517.1	183.3
La. Gulf Coast	688	339.9	58.2	147.3	39.7	11,307	1,953	4,358	920	716	351.5	78.4	189.3	52.5
N. La. and Ark.	107	31.4	7.7	17.0	6.4	5,291	689	2,534	202	106	51.1	6.9	24.0	6.4
Rocky Mtn.:														
New Mexico	26	19.1	0.7	4.4	3.1	887	62	145	142	25	12.4	0.7	4.4	2.5
Other	307	142.7	4.6	72.0	31.9	7,369	214	2,454	1,041	293	136.9	4.6	61.5	38.4
West Coast	1,131	567.7	...	201.6	306.1	30,705	370	11,237	15,980	1,096	538.1	7.2	195.1	285.7
Feb. 26, 1960	8,108	4,090.4	290.3	1,884.0	997.1	215,623	21,878	108,815	45,299	8,127	3,939.0	417.4	2,159.1	1,124.8
Feb. 19, 1960	8,081	4,074.0	299.9	1,802.7	969.3	212,942	22,987	112,597	46,421	.....	.....	.....	.....	.....
Feb. 27, 1959	8,236	3,995.1	358.7	2,181.0	1,069.0	207,744	19,593	81,634	54,582	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Colder weather helps distillate sales but not price

COLDER WEATHER during the last half of February and the first week of March has boosted dealer and jobber sales of heating oils but has done little for prices.

Wholesalers in the Chicago area certainly didn't think there was much chance for firmer fuel markets in March. They trimmed distillate prices 0.375 cent a gallon at the start of the month. This latest cut removes all ties between Group 3 and Chicago prices for distillates.

The new posting for Chicago carries a price of 8.75 cents a gallon for No. 2 fuel and 9.5 cents for No. 1 There have been rumors of Group 3 sales of No. 2 at 8.25 cents but market reports indicate a going spot price of about 8.5 cents. The 0.25-cent spread will cover only a fraction of the pipeline-transportation cost from Group 3 refineries. This price differential is definite proof the Chicago suppliers are certain they will not need Group 3 distillate for the remainder of this season.

Cold weather has not helped distillate prices on the Gulf Coast. And, here is a paradox. There is a good chance that the need for a spot cargo of No. 2 from the Gulf Coast would lower the posted price.

Here is the reasoning back of the statement. The distillate market is generally weak on the Gulf Coast. Most refiners on the Gulf Coast know that stocks have been high on the East Coast and that a reduction of 0.25 cent in the posted price for No. 2 fuel wouldn't bring a sale unless some marketer needed the fuel.

If an East Coast marketer decided to buy a spot cargo of No. 2 fuel on the Gulf Coast, he probably would not have to do much shopping to find a cargo at 0.5 cent off the current quotation of 8.00 cents a gallon. There would be so much competition for the business that most Gulf Coast refiners would know the exact sale price. This much publicity would tend to bring the general Gulf Coast posting near the actual price paid for the spot cargo.

The marketer could try a little private horse trading with some refiner known to be long on distillate, but the final price probably would become general market information in a matter of days.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M.	Wyo. (sour)
14-14.9	$1.76	....	....	....	....
15-15.9	1.84	....	....	....	$1.81
16-16.9	1.92	....	....	....	1.86
17-17.9	2.00	....	....	....	1.91
18-18.9	2.08	....	....	....	1.96
19-19.9	2.16	....	....	....	2.01
20-20.9	2.24	$2.49	....	$2.35	2.06
21-21.9	2.32	2.52	....	2.38	2.11
22-22.9	2.39	2.55	....	2.41	2.16
23-23.9	2.46	2.58	$3.44	2.44	2.21
24-24.9	2.53	2.61	3.46	2.47	2.26
25-25.9	2.60	2.64	3.48	2.50	2.31
26-26.9	2.67	2.67	3.50	2.53	2.36
27-27.9	2.74	2.70	3.52	2.56	2.49
28-28.9	2.81	2.73	3.54	2.59	2.54
29-29.9	2.87	2.76	3.56	2.62	2.59
30-30.9	2.93	2.79	....	2.65	2.63
31-31.9	3.00	2.82	....	2.68	2.67
32-32.9	3.06	2.85	....	2.71	2.71
33-33.9	3.12	2.88	....	2.74	2.75
34-34.9	3.17	2.91	....	2.77	2.79
35-35.9	3.22	2.94	....	2.80	2.83
36-36.9	3.27	2.97	....	2.83	2.87
37-37.9	3.31	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 9-11-59; East of California, January 3-10, 1957; Pennsylvania Grade 1-11-60.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.55
Middle District	4.37
Southwest Pennsylvania	4.10
West Virginia	3.92
Buckeye Grade	3.77
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodben	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz.	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down.

All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.90
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	10.50-10.75
Premium (99 octane)	13.00-13.50
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25-10.50
Regular (92 octane)	10.50-10.75
Premium (98 octane)	11.75-12.00
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.125
Premium (97 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50- 9.75
Diesel oil (58 d.i. and above)	9.25- 9.50
Distillate No. 1	9.25- 9.50
★Distillate No. 2	8.50
Gulf Coast (cargoes):	
Kerosine 41-43	9.00
Distillate No. 2	8.00
New York Harbor (barges):	
Kerosine 41-43	10.30
Distillate No. 2	9.30
Diesel fuel, 48-52 d.i.	9.60
Caribbean area (cargoes):	
Distillate No. 2	8.00

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

Carib.-NY, dirty (ATRS—65%)	$0.96
Carib.-UK, clean (Scale—45%) (17s. 11d.)	2.51
Carib.-UK, dirty (Scale—57½%) (13s. 10d.)	1.94
PG-France, dirty (USMC—67%)	3.60

★Denotes change from previous week.

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FOR SALE EQUIPMENT

1 HYDRAULIC CASING pulling machine, complete. Price $6,500. Sell or trade. Woodford Supply Company, P. O. Box 84, Phone CE-51454, Oklahoma City 1.

AN AUCTION

Thursday, March 17, 1960 10:00 A.M. (CST)

Healdton, Oklahoma

Auction to be held one mile South of Healdton on O. T. Stockton yard.

PIPE

5,075' new 3½" drill pipe, National 13.30# ext. upset, Grade D, Range 2 w/tool joints and protectors; 1,030' used 4½" full hole drill pipe.

18 TRUCKS & TRAILERS

Including Mack tandem truck w/oil field bed; Rig up truck; Truck tractors; Tank trucks; 8 Trailers including 4—5,000 gal. tank trailers, 2 tandem floats, one single axle float & one single axle pole trailer, 1958 Ford passenger car.

3 CABLE TOOL RIGS

3 drum Cardwell RL617 & 2-2 drum Cardwell (KL98 & R1452) complete with 3" & 3½", 4½" & 5" tools, derricks, steel dog house, line, etc.

DRILLING RIGS

To be sold piecemeal—2 6 cyl. EKU Waukesha; Bethlem M350 & Wilson draw works; 4' substructure; Clark Triplex 7¼ x 12 pump; 17½ Ideco rotary; Lee C. Moore double derrick; drill collars; elevators; slips; blocks; swivels; tongs; drilling line; mud line; ALSO: Well service unit w/telescope pole; Ford commercial engine; Joy generator; swabs; elevators; oil savers, rod strippers & much more.

MISCELLANEOUS

Acetylene generator; electric welder; air compressor; hand tools; ramp; tires; Wichtex draw works; Hundreds of other items related to the oil patch. Write for full list.

OWNERS: Blue Jay Oil Company
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TERMS: Complete payment sale day.
INSPECTION: March 10th till sale day.

This Auction Conducted by

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Phone PE 8-7931

FOR SALE EQUIPMENT

USED 170 H.P. D337 Caterpillar Diesel with 6,000 hours. Will sell reasonable. Contact Wayne E. Booker, R. R. #2, Calhan, Colorado.

FOR SALE OR LEASE: Three (3) large perforating trucks complete with 16,000' of 7/16" single conductor line. These units are ready for the field. Box L-614, The Oil and Gas Journal, Tulsa, Oklahoma.

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COMPRESSORS, Clark Gas RA-5; Clark Cent. 7,860 CFM 2 Stage
CONDENSERS 7,500 to 100 sq. ft.
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1—ALDRICH 3½" x 7" Triplex salt water pump, with Lufkin gear reducer and 100 HP electric motor. Capacity 6,000 bbl. per day, 820 lbs. pressure. Price $3,500.00. Woodford Supply Company, P. O. Box 84, Phone CE 5-1454, Oklahoma City 1.

WELL DRILLS—CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

BUDA POWER UNITS: Unused surplus, new condition. Four cylinder, 121 HP gasoline engines. Complete with radiator. Twin disc clutch and 5 sheave V-belt drive pulley. Can be operated on LP or natural gas. Priced at fraction of cost, $1,495.00 each. Photograph and complete specifications on request. Oldfield Equipment Co., 430 West Seymour Ave., Cincinnati 16, Ohio.

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BOILERS, 5—70,000 #/hr. 450 Psi.
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FURNACES, 15 MM & 34 MM BTU/hr.

19,000 BBL. MIV CAT CRACKER

CENT. COMPRESSORS, 38,000, 9,370 & 5,535 CFM.
CENT. PUMPS, 15 to 7,000 GPM.
TURBINES, 5 to 1,400 HP.
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1 —**USED** 127' Lee C. Moore Bolted Type Mast Mounted on 7' high Substructure. Located Oklahoma City. Price $11,000.00

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5,000' of 4½" Grade E Drill Pipe, Hughes Shrink Rip Tool Joints, square shoulder. $2.00 per ft. located Duncan, Oklahoma, extra good condition, call CEntral 2-6318, Oklahoma City.

5,000 FT. of 16" O.D. 31# Weight Spiralweld Steel Pipe in 40 Ft. R/L. Suitable for surface casing, pressure lines, drainage or road crossing pipe. Good used condition. Price, $3.00 foot F.O.B. our yard. Write or phone: M. Kaplan & Sons Inc., Monroe, Louisiana, FAirfax 2-5112.

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Sucker rods, line pipe, tanks and pumping units.
All No. 1 Grade—Used
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8 Mack Tractors LEVSW (modified) 600 H.P. Cummins. With or without 10 ft. x 40 ft. Insulated Trailers. These Trucks are 202 inch Wheelbase, 10 ft. width. Tires 16.00 x 25. 5 Trucks in Montana & 5 Trucks in Anchorage, Alaska. Write P. O. Box 1410, Fairbanks, Alaska.

Cardwell RL, Serial 679, powered by 145 GK Waukesha, Serial 862887. Skid mounted, double 55 foot poles, spudding attachment, 4,000 feet of new ¾" left lay drilling line and approx 4,000 feet of 9/16" sand line. Rig is in good condition and ready to work. Price for rig alone $5,500.00, with tools $7,000.00. Located at our yard Redfield, Iowa. Kirby Well Service, Inc. 5107 Center St. Omaha 6, Nebraska, Tel. # WAlnut 3575.

ASPHALT UNIT—1,000-barrel capacity consisting of vacuum pump, complete with vacuum jugs and 2 vacuum towers, 20-horsepower GE 22/440 volt motor; one 3,000-barrel and two 2,000-barrel all welded tanks insulated; miscellaneous asphalt heaters; cooling tower; loading racks; lab equipment, etc. Write Box 637, Hardin, Montana. Phone 642.

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co., Inc., Dumas, Texas. Phone WE 5-5019 or WE 5-4369.

FOR SALE—Excellent Water Flood Prospect, Located Old Somerset Field, Atascosa County, Texas. Leases are ⅞ and adjoining. 2,600 acres of the 3,000 acre block are unitized.
Three producing and one input well on premises.
Best sand is Olmos at 1,500'. Sand thickness 20-30'. Oil in place, 1,200 bbls. per acre foot with 600 estimated receivable with effective water flood. Treated salt water moves oil through cores.
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6 HBGG Worthington units complete with 150 h.p. NKR Waukesha engines.

2—17" x 13" single units
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FOR SALE: Oil loading rack, six railroad cars 200 ft. long, complete with 4 inch supply pipe, 3 inch laterals, valves and swing pipe. Fair Oil Co., Box 689, Tyler, Texas, Telephone LY 2-3811.

1-Type C-350 National Ideal 7¾" x 18" duplex slush pump equipped with standard 64" 20-D section sheave, Rebuilt Condition. O'Neal Taylor & Company, Box 22021, Houston 27, Texas. Phone GY 98112.

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WANTED: Gardner Denver 5 x 10 pump, with high pressure fluid end. Also Triplex Plunger pumps. Write P. O. Box 65, Clarkwood, Texas.

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REFINERY MAINTENANCE Engineer with at least two to three years experience, willing to develop into maintenance supervisor for modern refinery in mid-continent area. Our employees have been informed of this advertisement. Box L-731, The Oil and Gas Journal, Tulsa, Oklahoma.

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HELP WANTED

PETROLEUM ENGINEER, with M. S. degree and 3-5 years experience, perferably in Reservoir Engineering. Wanted for assignment in Reserves and Evaluation. Personnel Department, Skelly Oil Company, Box 1650, Tulsa, Oklahoma.

LAND MAN to be in charge of securing options and leases for large reputable mining firm conducting exploration in Missouri. Full time job, several years experience preferred, salary open. Send work references with application. Reply to: Box L-750, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN for position with a future in organization of aggressive independent oil producing company with offices in Tulsa, pursuing exploration activities in Rocky Mountain, Mid-Continent and Tri-State Areas. Should have 10 years experience in all phases of land work and possess executive potential. Reply giving complete details, age and salary requirements to Box L-746, The Oil and Gas Journal, Tulsa, Oklahoma.

FELLOWSHIPS and assistantships—Graduate work in Petroleum Production Engineering—September 15, 1960. Exemption from tuition and most fees. Fellowships offer stipends from $1,500 to $2,000. Research Assistantships which allow ten credits per semester toward an advanced degree pay $190 per month. Apply early—deadline for some of the better appointments is March 15, 1960. Reply to: Dr. R. L. Slobod, Petroleum and Natural Gas Engineering, The Pennsylvania State University, University Park, Pennsylvania.

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Box L-739, The Oil and Gas Journal

Tulsa, Oklahoma

SITUATIONS WANTED

GEOLOGIST, M. S., 46. 15 years stratigraphic, structural, subsurface, wellsite, core and surface experience. Publications in U. S., U. K., Australia. Full resume on request. Will travel. Desires position in oil exploration. Box L-648, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST, M.S., Mining Engineer, equivalent Ph.D. level in geology, 25 years domestic and foreign experience in oil exploration with major oil companies, presently employed in geophysical research group, seeks employment with broader scope. Speaks four languages, married, no children. Box L-751, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER: 9 years experience in gasoline plant, oil production, refining and petrochemical economics. 7 years technical aid to operations during construction, startup and operation of petrochemical and chemical plants. Age 38. Desires position with petroleum or chemical company. Box L-752, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS ENGINEER with 8 years diversified experience in the oil and gas industry, both in domestic and foreign operations, desires challenging position with major or well integrated independent preferably in Texas. Experience includes Production Engineering, Drilling Engineering, Reservoir Engineering, Gas Operations, Construction, etc. Complete resume will be furnished upon request. Sales contact or manufacturers representative position will be considered. Box L-754, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PRODUCTION SUPERVISER, 50, 31 years with major oil company. Experience in drilling and producing in Gulf-Coast, South, Central, West Texas and Louisiana Gulf-coast and off-shore. Roustabout to Production Superintendent. Presently employed as a production supervisor. Desire employment with aggressive small or independent oil company. Box L-738, The Oil and Gas Journal, Tulsa, Oklahoma.

RIG MAINTENANCE Mechanic: 20-years experience. Recommendations on request. Will relocate. Call: J. E. Jones, 4714, Kilgore, Tex. or write; 406 Florey Ave.

PHOTOGRAPHER: 7-years experience oil industry. Public relations, advertising. Stills, movies, color, processing, training films. Presently employed. Box L-744, The Oil and Gas Journal, Tulsa, Oklahoma.

GASOLINE PLANT superintendent— Age 44, 25 years experience in all phases of the gas industry, including construction operations, maintenance. Furnish references. Available immediately. Box L-743, The Oil and Gas Journal, Tulsa, Oklahoma.

PERSONNEL DIRECTOR, 10 years experience personnel director medium sized oil company. Organized, developed, administered program including employment, benefits, safety, personnel policies, organization planning, other related areas. Close contact all levels management, field and office. Box L-740, The Oil and Gas Journal, Tulsa, Oklahoma.

FORMER DIVISION reservoir engineer, for major, drilling and production experience. Married, 32, speaks Spanish. Will accept foreign or domestic employment. 412 High, Newton, Kansas.

ADMINISTRATIVE secretary, 39, single, 10 years experience with major Venezuelan oil producer; desires relocate Latin America, but will consider other foreign employment. Box L-753, The Oil and Gas Journal, Tulsa, Oklahoma.

AIRCRAFT

CESSNA 195-A, 5 place, 275 H.P. Jacobs, Chrome Wall engine, cross wind gear, complete panel, ADF, omnigater, perfect, low time. Will trade for oil well equipment or casing. Luke Wise, Community Gas & Oil Co., Billings, Montana.

PRODUCTION WANTED

$500,000-$1,000,000. GAS purchase wanted. Principals only. Engineering desired. Box L-747, The Oil and Gas Journal, Tulsa, Oklahoma.

A CALL TO ARMS!

As an independent oil and gas producer, I am tired of seeing United States markets flooded with foreign oil and gas. There is a plan afloat whereby various companies intend to take over more United States markets, with Canadian gas. Ample gas, here in the United States, already uncovered, and waiting to be uncovered, will supply all of our needs for many, many years to come. Help me in this fight to preserve United States markets for United States gas!

W. R. (RAY) WIGHT

P. O. Drawer 150 Beaumont, Texas

LEASE AND DRILLING BLOCKS

FIFTEEN THOUSAND acre block, state oil lease, Luna County, N.M. for sale, or will lease with drilling obligations, adjoins Major Company's leases, who will support test drilling, area on defined Structure. E. R. Wright, P. O. Box 423, Deming, N. M.

Have buyer's for Oil and Gas Producing Properties. Box L-729, The Oil and Gas Journal, Tulsa, Oklahoma.

KENTUCKY—2,800 acres, Casey County, $5.00 acre. All or part. North of exceptional play. Box L-728, The Oil and Gas Journal, Tulsa, Oklahoma.

WILLISON BASIN in Dakota—oil and gas mineral leases. Shallower drilling; six possible pay zones; drilling operations of two wells to start within 60 to 90 days, on large block. For available direct interest or farm-out, write: P. O. Box 495, Aberdeen, South Dakota.

50 ACRES Eastern Kansas. Diagonal offset Bartlesville Sand 700 ft. Need help on drilling. Reply: Box L-718, The Oil and Gas Journal, Tulsa, Oklahoma.

14 OIL WELLS, 5 water injection wells. 560 acres. Production, approximately 20 barrels daily. 700 ft. depth. On pipeline. Engineers say drilling additional wells will make a money making, long lived flood. Southeast, Kansas. Box L-715, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2,000 acres. Write quickly to: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

SALE OR MERGER—Eastern Kentucky. About 1,200 acres leases with 5 gas and 1 oil well. Also Natural gas utility with 450 customers, 1,300 acres leases with 6 gas wells and 900 more customers waiting for more gas. M. W. Kimball, 1844 Wood St., Muskegon, Michigan.

LICENSED DEALER solicits submittals of minerals for sale, wildcat or proven, East Texas only. Box L-749, The Oil and Gas Journal, Tulsa, Oklahoma.

GREEN COUNTY Kentucky oil production for sale. Box L-748, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW WATERFLOOD Prospect—Eastern Kansas—240 acres, old proven Wayside Sand production, 675 feet; nearby Wayside production being successfully waterflooded. Core analysis shows 15,500 barrels of oil per acre, average. Price includes 4 pumping wells, tanks, etc. and drilling a 5 spot injection well, and a complete water injection system. ¼ working interest $3500.00 Good engineering and geology; established drilling and water-flooding company. Aztec Drilling Co., 401 Fourth National Bank Bldg. Wichita, Kansas.

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Lab analysis of cores from recent well indicate 10,000 to 20,000 Bbls. of pipe line oil left in formation after primary period. Depth 1,600'. Can be flooded or mined. This is not an offer for sale.

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This is not an offer to sell nor a solicitation of an offer to buy securities. The offering is made only by the offering sheet, a copy of which may be obtained upon inquiry addressed to:

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115 University St.
Siloam Springs, Arkansas

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OIL PRODUCER seeks individuals with capital who wish to make direct investments in the drilling of wells for oil and gas in areas of favorable geology. The prospects will not be wildcats but are chosen for drilling because they are near or in areas of proven production. Will supervise the drilling and completion of the wells on a cost or turnkey basis. Box L-755, The Oil and Gas Journal, Tulsa, Oklahoma.

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ELECTRICAL LOGS, several thousand. West Texas-Southeast New Mexico. Bargain price. Box L-727, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED—Complete or near complete set 1"=100 electric logs for Mississippi. Box L-732, The Oil and Gas Journal, Tulsa, Oklahoma.

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AGENTS WANTED throughout U.S.A. and foreign to market the Macro downhole casing testing tool. Proven in over 1,000 field tests. Excellent profit margin for very small investment. Write: Macro Limited, 534—6th Avenue S.W., Calgary, Alberta, Canada or phone Calgary AMherst 3-2839.

MONTGOMERY COUNTY, Kansas, oil and gas mineral leases. Several Bartlesville wells producing from 1,200 ft.; possibility of Arbuckle wells about 1,800 ft. Have drilling equipment. Want financial partner to help develop. Write: P. O. Box 2025, Tulsa 1, Oklahoma.

OLD EXPERIENCED, Responsible Ohio Oil and Gas Producing Company now operating in practically all active areas of Ohio, has wildcat, semi-proven and proven acreage to offer as well as a completely integrated management, development and operational organization to supervise service and manage your Ohio operations. Inquiries are invited from individuals, companies and other interested parties. References available. Box L-745, The Oil and Gas Journal, Tulsa, Oklahoma.

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by modern, well established and experienced company with complete development, manufacturing and marketing facilities. Interested in new, patented or patentable oil field specialties or equipment items on royalty basis or outright purchase. Give identification and general use of product in reply to:

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THE OIL AND GAS JOURNAL
TULSA, OKLAHOMA

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LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that 999.02 acres of land in five parcels, within the known geologic structures of the Clareton field, Wyoming, and the Hugoton field, Kansas, are offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:00 P.M., April 14, 1960, when bids will be opened. Full details of the offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Chief, Minerals Adjudication Unit.

LEGAL

SALE OF OIL AND GAS MINING LEASES, TRIBAL AND ALLOTTED INDIAN LANDS, DEPARTMENT OF THE INTERIOR, BLACKFEET INDIAN AGENCY, BROWNING, MONTANA. Sealed bids will be received until 10:00 A.M., Mountain Standard Time, March 16, 1960 and opened at that time in the office of the Superintendent, Blackfeet Indian Agency, Browning, Montana, for leasing of 23,223.04 acres of Tribal and 25,243.80 acres of Allotted land located in Township 36 North, Ranges 6 and 7 West; Township 35 North, Ranges 6 and 7 West; Township 33 North, Range 6; Township 32 North, Ranges 13, 12 and 6; Township 31 North, Ranges 11, 12 and 13; Township 30 North, Ranges 11 and 12 in Glacier County for Oil and Gas Mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Superintendent of the Blackfeet Indian Agency at Browning, Montana.

Addendum Notice

The date of the sealed bid opening which was scheduled for March 16, 1960 at 10:00 A.M. has been changed to March 30, 1960 at 10:00 A.M. The date of bid opening is extended to include omitted acreage previously requested and to permit advertisement of such lands for at least 30 days in accordance with 25 CFR 171.3 and 172.4. The total acreage offered is 24,031.80 acres of Tribal land and 26,083.80 acres of allotted land.

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P. O. Box 1260 Tulsa, Okla.

More discovery wells

OKLAHOMA

Cleveland County:

J. A. Chapman and G. C. Parker 1 Bruesch, NE NE NW 6-9n-1w. IP 192 BOPD, 15 BWPD, 39°, Red Fork 6,220-28 ft. TD 7,295 ft. New field.

J. A. Chapman 2 Kunc-Robertson, NW NW SE 6-9n-1w. IP 50 BOPD, 39°, Red Fork 6,246-61 ft. TD 7,265 ft. New field.

Ellis County:

Pan American 1 Bayless Operating Unit, C NW SE 23-20n-24w. IPF 36 BOPD, Tonkawa 7,244-7,315 ft. TD 10,903 ft.

Garfield County:

Jocelyn-Varn Oil Co. 1 Miller, C SE 14-24n-6w. IPF 76 M.M.c.f.d., Skinner 5,430-54 ft. TD 5,495 ft. New field.

Lincoln County:

Earl E. Barnes 1 Wertman, SW SE SW 12-15n-4e. IP 144 BOPD, 47°, Cleveland 2,892-2,902 ft. TD 3,910 ft. New field.

Logan County:

T. P. Petroleum 1 Nakvinda, SE SE SE 7-15n-4w. IPF 2,000 M.c.f.d., Bartlesville 6,470-80 ft. TD 6,800 ft. New field.

Major County:

Gulf Oil Corp. 1 H. C. Wichert, SE SW 14-21n-13w. IP 607 M.c.f.d., Chester 7,110-22 ft. TD 9,538 ft.

McIntosh County:

Tidewater Oil Co. 1 Sizemore-Winkle, C SE SW 25-11n-17e. IP 2,500 M.c.f.d., Georges Fork 1,110-23 ft. TD 3,009 ft. Georges Fork discovery.

Oklahoma County:

Jones & Pellow Oil Co. 1 Wagoner, SW SW 1-13n-1e. IP 1,000 M.c.f.d., 1.5 BD, 59.6°, Skinner 5,088-94 ft. TD 5,272 ft.

R. Stenzel 1 Roberts, SW SW SE 19-14n-1e. IP 172 BOPD, 38°, second Wilcox 5,708-12 ft. TD 5,712 ft.

Texas County:

Cities Service Oil Co. 1 Republic "A," NE NE SW 33-5n-15eCM. IP 342 BOPD, Morrow 6,126-6,130 ft. TD 6,571 ft. New field.

WEST TEXAS

Andrews County:

Pan American Petroleum Corp. 5-JJ University, 12 miles west of Andrews in Sec. 44, Blk. 13, Univ. Lands Survey. IPF 339 BOPD, 12/64-in. choke, 43.9°, Ellenburger 10,936-56 ft. TD 11,120 ft. Dual completion. IPF 234 BOPD, 24/64-in. choke, Devonian 8,826-40 ft. Dual oil discovery.

Pecos County:

Phil H. Hayes 1-A University Lands, 14 miles west of Iraan, Sec. 9, Blk. 16, Univ. Lands Sur., 2 miles west of Walker field. IPF 186 BOPD, 15/64-in. choke, 28.5°, Wolfcamp 5,910-30 ft. TD 6,663 ft. New oil discovery.

WEST CENTRAL TEXAS

Stephens County:

Texoma Production Co. 1 Odessa Smith, 11.5 miles northeast of Breckenridge in northeast part of county, Sec. 5, Blk. 3, SPRR Sur. IPF 116.48 BOPD, 12/64-in. choke, 41°, Conglomerate 3,974-82 ft. TD 4,546 ft. New oil discovery.

Throckmorton County:

Bill Lisle 1 Dena Parrish, 5 miles south of Woodson in southeast part of county, Sarah Blythe Sur. 2. IPP 71.20 BOPD, 37°, Strawn 2,854-58 ft. TD 2,975 ft. New oil discovery.

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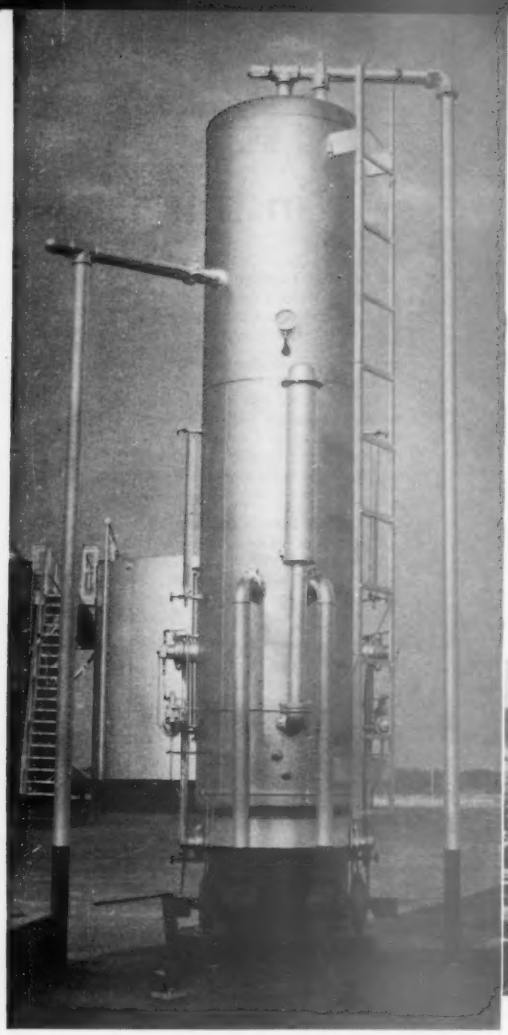

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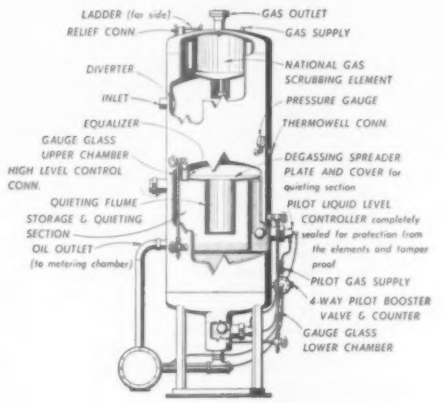

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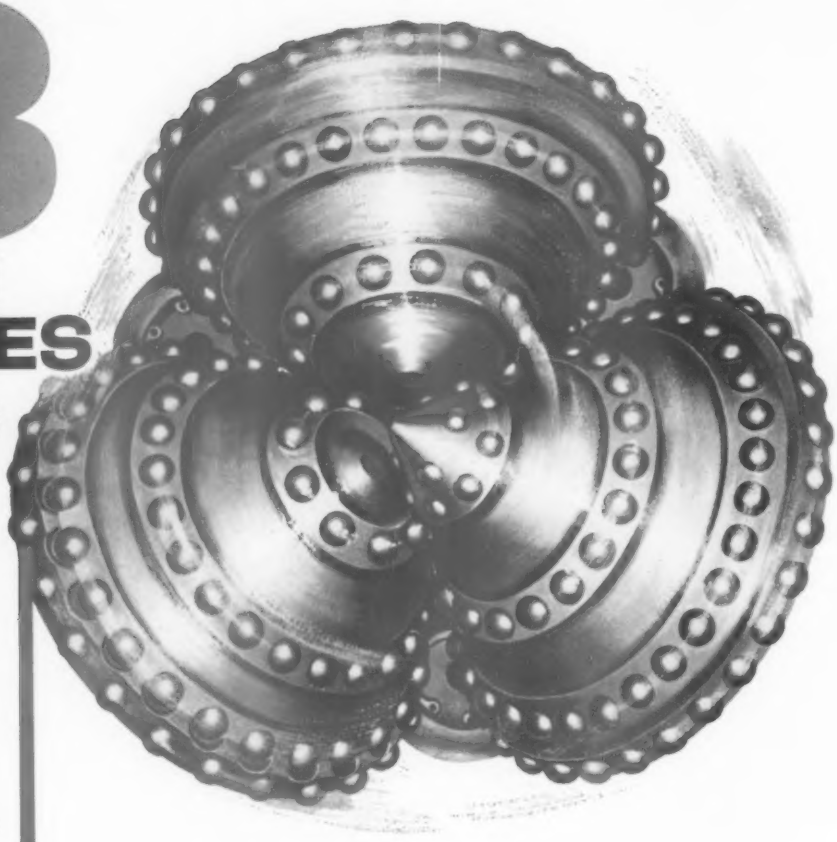

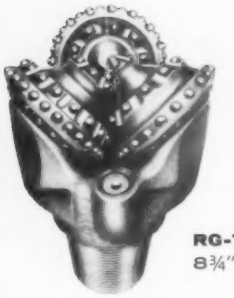

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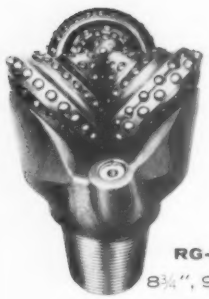

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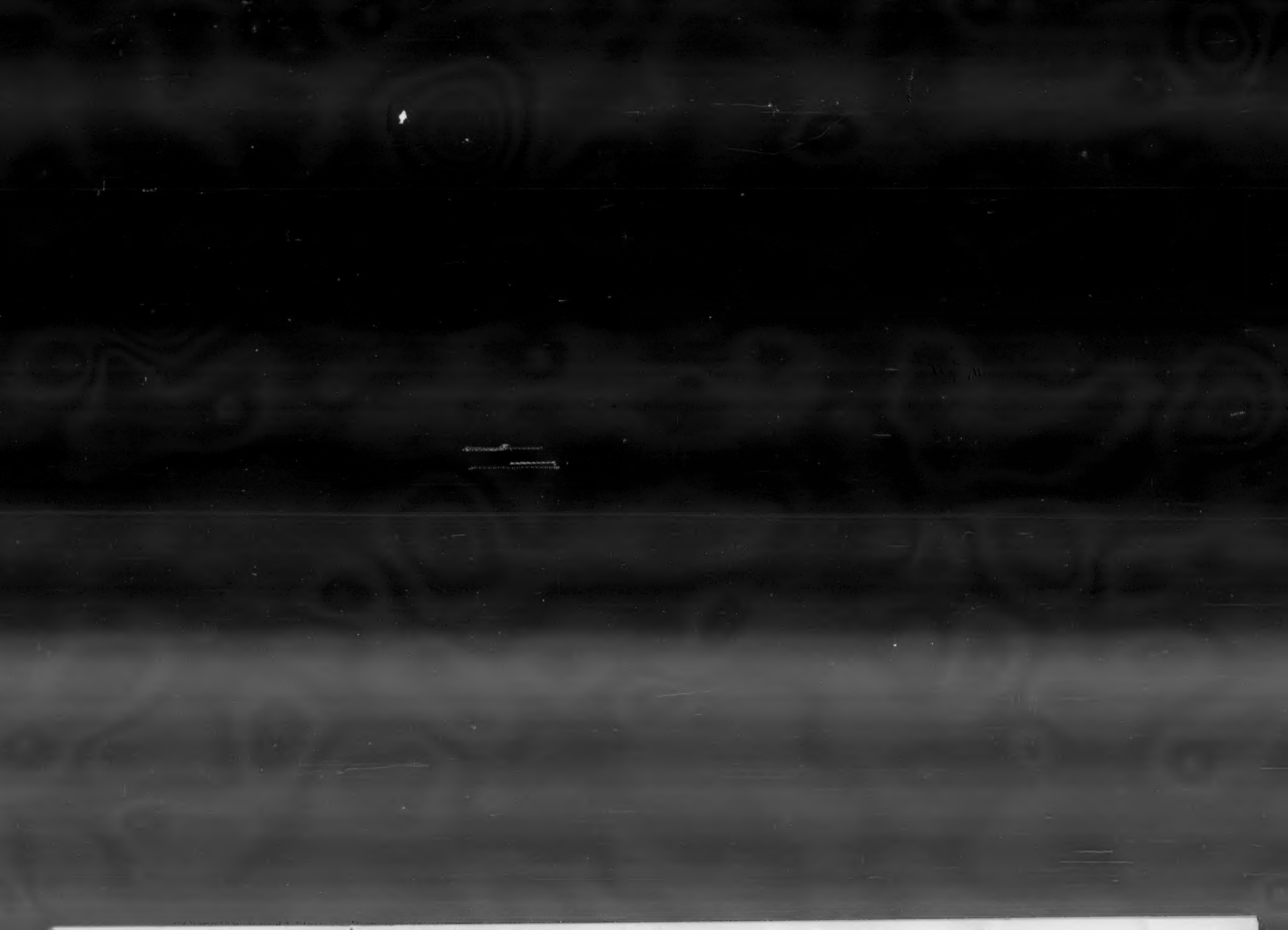
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